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SYNTACTIC ASPECTS OF EMOTIONAL EXPRESSION

BY

GARY COLLIER ©

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF PSYCHOLOGY
EDMONTON, ALBERTA
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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Syntactic Aspects of Emotional Expression" submitted by Gary Collier, in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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Date June 25, 1976

ABSTRACT

Twenty subjects were asked to recall and describe a time when they felt various emotions. Syntactic differences within the descriptions of both discrete emotions (happiness, sadness, anger, fear, liking, disliking, and curiosity) and emotional dimensions (evaluation, intentionality, and strength) were then analyzed according to the phrase structure and transformational rules contained within Noam Chomsky's model of transformational grammar. While differences occurred among discrete emotions, dimensional differences seemed most systematic and accounted for all but four of the 19 differences occurring among discrete emotions: descriptions of weak experiences contained more grammatical errors. Descriptions of intentional emotions were characterized by increased use of direct and indirect objects, and descriptions of unpleasant emotions were characterized by increased modification and grammar complexity.

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Though the field of emotional expression can be partitioned in a number of different ways, one of the most useful divisions seems to be Erwin Goffman's (1959) distinction between aspects of communication that are "given", i.e., communicated in the traditional, narrow sense by way of verbal symbols or their non-verbal substitutes, and those aspects of communication that are "given off", i.e., expressed unintentionally without a person's awareness and often without his control. A similar distinction is made by Wiener, Devoe, Rubinow, and Geller (1972) who contrast non-verbal "communication" with non-verbal "signs". Communication implies a socially shared signal system, an encoder who makes something public via that code, and a decoder who responds systematically to that code. Signs, on the other hand, imply only an observer making an inference or assigning a significance to a behaviour. Spiegel and Machotka (1974), who are concerned primarily with kinesic behaviour, suggest substituting the term "presenting behaviour" or "(re-)presenting behaviour" for "expression", where "presentation" means the intentional arrangement of stimuli emitted in the presence of another person in order to evoke a desired response.

In spite of the conflicting terminology, it is clear that all of the above writers are trying to distinguish what appear to be two clearly defined and mutually exclusive uses of the term "emotional expression". The first is the intentional use of a conventionalized code by an encoder in the presence of a decoder to communicate one's emotional state. The second is the unintended expression of one's emotional state by certain aspects of one's behaviour, often in spite of attempts to restrict the expression.

The intentional communication of emotional states includes not only the verbal communication of one's state through language but non-verbal aspects as well. These include the use of conventional body posture and gestures, probably the handling of personal space (proxemics), and those aspects of facial expression either brought under conscious control or used to control the expression of less restrained facial movements. Unintended expression seems to include most paralinguistic features (i.e., tone of voice), unrestrained facial expression, and physiological changes such as flushing, trembling, increased heart beat, phelodilation, and so on, which Darwin (1872) accounted for by direct action of the nervous system.

A key factor distinguishing these two modes of expression is that the first seems to be highly flexible, easily learned and changed, and shows a great deal of cultural variability, wheras the second is inflexible and shows little or no cultural difference. Trembling, for example, seems to be universally expressive of the emotion of fear, and it seems ludicrous to suggest that trembling is the result of an intentional urge to communicate this emotion to others.

As Goffman (1959) has pointed out, because people often try to create a good impression, others often test the validity of impression by examining ungovernable aspects of behaviour. For example, people often refer to facial expression or a speaker's tone of voice in order to validate the message being communicated by his words. This type of cross-channel comparison is especially common among therapists, particularly psychoanalysts, where the emphasis is on going beyond the emotions and attitudes intentionally communicated by a client in order to probe at deeper underlying states. Ferenczi (1914) and Feldman (1959), for example, interpreted the underlying significance of specific mannerisms and gestures, whereas Reich (1945) described the psychological significance of certain types of movements and patterns of muscular rigidity. More recently, Mahl (1959) has suggested that certain forms of speech disturbances are indicative of anxiety. All of these represent attempts to systematically describe the expressive significance of channels other than verbal content in order to identify independent sources for validating emotional states.

The purpose of this dissertation is to suggest that syntax or the grammatical structure of one's language is also expressive of emotional states and to systematically study differences in the syntactic structure occurring among people's description of recalled emotional experiences. Syntax seems to be a particularly good indicator of emotional attitude for two reasons. First, people do not intentionally communicate their emotional state through grammatical structure and there is good evidence that the structure itself is not recalled beyond the immediate time needed for coding (Sachs, 1967). Second, syntactic differences can be systematically and comprehensively analyzed without devising new descriptive models by utilization of existing linguistic descriptions.

The present investigation of syntactic aspects of emotional expression differs from previous studies in a number of ways. First, the majority of psycholinguistic studies of syntax has been concerned with issues that are, at best, only indirectly related to emotional expression. Second, researchers who have attempted to study the relationship between syntax and emotional states have usually focused on a single variable (e.g., negation, verb tense) or a single relationship between a set of variables (e.g.,, verb/adjective ratio) rather than adopting a complete grammatical description. Third, those few attempts to use a wide range of linguistic variables to investigate emotional states have usually involved a combination of syntactic and semantic features. Finally, because much of the previous research in emotional expression has stemmed from clinical interests, the emphasis has been almost exclusively on negative effects, particularly anxiety (Mahl & Schulze, 1964).

With regard to the first point, most psycholinguistic studies of syntax, including empirical research originating from Chomsky's theoretical conjecture, have dealt with issues not directly related to emotional expression. As Greene (1972) has pointed out "the chief attraction of Chomsky's 1957 theory for psychologists was the possibility that generative rules are the same as those used by speakers to produce sentences (P. 108)." Much of the early psycholinguistic research generated by Chomsky's theory during this period was concerned with testing the psychological reality of these transformational rules. While this type of research might have led to studies concerned with the relationship between specific transformations and dispositional states, no research was done in this area and the majority of studies was concerned with the effects of transformations on processing time and memory. George Miller (Miller & McKean, 1964) proposed that, if grammatical transformations have a psychological reality, then the time necessary to generate or retrieve a sentence would be directly related to the number of transformations involved. To test this, Miller and McKean used passive and negative transformations and had subjects transform sentences of one type into combinations of other types, (e.g., active sentences into passive, negative, and passive-negative sentences; passive sentences into active, negative, and passive-negative sentences, etc.). They found that the time necessary for a given transformation was fairly consistent, that the times necessary for multiple transformations were additive, and that the time needed for deriving a transformed sentence from an active or deriving an active from a transformed sentence was much the same. The latter finding suggested that encoding and decoding processes were mirror images. Other studies were carried out testing the effects of transformations on the ability to memorize sentences (Savin & Perchonock, 1965; Mehler, 1963) and the ability to evaluate the truth value of sentences (McMahon 1963; Gough, 1965, 1966; Slobin, 1966).

While the ingenuity of the procedures used and the subtlety of the comparisons made defies any attempt at brief review, Green's (1972) general conclusion is that, after Miller's preliminary suggestive findings, the majority of research in this area failed to find a one-to-one correspondence between transformational complexity and performance and that part of this failure was due to the interaction of semantic and syntactic factors.

This failure led directly to attempts to incorporate syntactic and semantic factors, including Chomsky's own incorporation of semantic feature rules in his 1965 Aspects model. This then generated a new line of research concerned primarily with the relationship between syntax and semantics, particularly the effects of syntax on implicit meaning, emphasis and salience. The most frequently studied variable of this type seems to have been the passive transformation. Clark (1965) showed that when people were asked to fill in the blank in active and passive sentences, more animate nouns were assigned to the deep structure object of passive sentences (i.e., the surface subject). Segal and Martin (1966) found that the surface subject of both active and passive sentences were rated as the "most important" element in the sentence. Johnson (1967) found that ratings of activity and potency based on Osgood's (Osgood, Suci & Tannenbaum, 1957) semantic differential tended to be higher for surface subjects, again for both active and passive sentences. Such findings suggest that the occurrence of a passive serves to increase the salience and apparent activity of the of the deep structure object. Similar research has been done on other syntactic-semantic relationships. Wason (1965), Clark (1970), and Greene (1970) have investigated the semantic restraints on the use of negation. More recently, Osgood and Richards (1973) have studied the effects of semantic congruency on choice of conjunction. They found that and is preferred for congruent pairs, whereas but is used for incongruent pairs.

As this brief review suggests, while there has been research investigating the relationship between syntax and semantics, there has been no direct investigation of how these areas relate to emotional expression or the communication of emotional states. The present study, on the other hand, is concerned explicitly with how variations in the type of emotional experience being described affects the syntactic structure of those descriptions. Also, unlike the previous studies which emphasize semantic interpretations made by the reader, the present study emphasizes the speaker and the effects of dispositional variables on the form of the sentences produced.

But the present study also differs from a second group of studies -- those concerned specifically with the relationship between linguistic variables and the expression of emotional states and personality types. Though much closer to the present investigation in terms of aims and objectives, this research has usually been limited to studies using only a single linguistic variable or a single relationship between a set of variables. This type of research has a rather long history.

Both Freud (1901) and Jung (1918) recognized and interpreted aspects of speech (slips of the tongue and verbal associations, respectively) as symptoms of personality dynamics. But the first attempt to use a syntactically related variable began when Buseman (1925) correlated the ratio of verbs to adjectives in stories by children with teachers' ratings of the children's emotional stability. The verb/adjective ratio has since been found to vary directly with anxiety (Balkin & Masserman, 1940; Back, Mahl, Risberg & Solomon, 1955; Gottschalk & Hambidge, 1955), diagnostic status (Mann, 1944; Hays, Gellerman & Sloan, 1955), and other linguistic variables, such as the Type-Token Ratio (Back, et al, 1955) and Mahl's (1959) speech disturbance ratio (Krause, 1961). Other parts of speech (e.g., the noun-verb/adjective-adverb ratio) have been found to be correlated with motivation level (Osgood, 1960); and verb tense has proven to be correlated to both diagnostic status (Fairbank, 1944) and participation in psychotherapy (Seeman, 1949; Zimmerman & Langdon, 1949; Grumman, 1950). More recently, Weintraub and Aronson (1967) have found that negation is more common in the speech of depressed patients.

The underlying assumption which has guided most of this research[1] is that if a syntactic variable consistently co-occurs with a specific emotional state or personality type, then differences among these variables can be used for predicting emotional states and for psychodiagnostic purposes. This conviction has led Carroll (1961) to describe stylistic variables as "projective techniques with potential utility similar to that of Rorschach or TAT test (P.102)."

Though related to these studies and retaining their basic theoretical assumption, the present study differs from research of this type in that it makes use of a much wider range of syntactic variables. Instead of investigating a single variable (e.g., negation or verb tense) or a single relationship between a set of variables (e.g., verb/adjective ratio), the present study adopts a complete grammatical description (i.e., Chomsky's model of transformational grammar), which is capable of describing and cataloguing differences in a wide range of syntactic variables.

A third general issue is that previous attempts to use a wide range of linguistic variables to assess affect-related phenomena such as motivation level (Osgood, 1960), psychodiagnostic status (Weintraub & Aronson, 1967) and verbal immediacy (Wiener & Mehrabian, 1968) differ from the present study in that no attempt was made to restrict the indices to syntactic variables. Instead, these studies made use of both syntactic and semantic variables. While the addition of semantic variables is not a hindrance in itself, these studies also differ from the present investigation in that, although they are far more comprehensive than studies investigating a single variable, they still deal only with a small subset of the syntactic variables available for investigation and the incorporation and treatment of syntactic variables within these studies are not dealt with in a systematic way.

The best example of this type of approach is probably Wiener and Mehrabian's (1968) measure of non-immediacy, which they define as "the amount of separation, non-identity, attenuation of directness, or change in intensity of interaction among the communicator, the addressee, the object of communication, or the communication, as indicated in the literal form of a communication." (p.32). While actually a content analytic procedure, their measure includes features that might be handled more precisely by syntactic categories or modified syntactic categories, if syntax alone lacks the specificity needed. For example, five of the nine categories postulated for non-immediacy are assigned to statements with some sort of adverbial modification: (1) The spatial category is assigned to adverbs of place (e.g., clauses introduced by "where"), (2) the temporal category is assigned to adverbs of time (e.g., clauses introduced by "when","during", or "while"), (3) the passive category is assigned to adverbs of purpose (i.e., statements with additional qualification beginning with words like "because"), (4) the modified category is given to adverbs of manner (e.g., "obviously","apparently", etc.), and (5) the intensity-extensity category is made up almost exclusively of adverbs of the type "rarely", "never", "hardly", etc.

The non-immediacy measure is in many ways representative of the type of research using a multivariable approach. On the one hand, it is a reliable measure which has been shown to be consistently related to a number of behavioural indices. On the other hand, it contains a combination of intuitively derived semantic and syntactic features. The point is that non-immediacy, and measures like it, might be greatly simplified and extended if they were to start with the more easily identifiable syntactic features, then proceed to finer discriminations based on semantic considerations. For example, five of the nine categories making up non-immediacy are directly related to a single syntactic variable, i.e., the amount of adverbial modification. If this variable were first introduced, then differentiated for each of the five categories, its introduction would lend considerable economy to the measure and might well increase its reliability.

Finally, the present experiment differs from previous research investigating the relationship between syntax and emotional states in that it is concerned with a much wider range of emotions. Since most of the previous research has stemmed from clinical interests, the emphasis has been almost exclusively on negative affects, particularly anxiety (Mahl & Schulze, 1964). The present experiment will be directed toward describing syntactic differences in a wide range of both positive and negative emotions (liking, happiness, interests, anger, fear, sadness, disgust) and between dichotomous poles of several emotional dimensions (evaluation, intentionality and strength).

To summarize, the present experiment differs from previous research in four ways. First, whereas the vast majority of psycholinguistic research has been concerned with issues other than emotional expression, the emphasis of the present study is exclusively emotional expression. Second, while those studies dealing with the relationship between linguistic variables and emotional states have usually been limited to a single variable or a single relationship between a set of variables, the present study will be concerned with differences in a much wider range of syntactic variables. Third, previous attempts to use a wide range of linguistic variables to assess dispositional states have commonly used a combination of syntactic and semantic features, but the present study is concerned exclusively with syntactic differences. Finally, the present study is directed toward describing syntactic differences in a much wider range of emotions than previously investigated. In short, while there have been previous attempts to use linguistic variables to study a small group of emotional states, there has yet to be a study which has applied a comprehensive, but specifically syntactic, linguistic description to the field of emotional expression.

Chomsky's (1965) model of transformational grammar provides such a description by postulating two sets of rules capable of accounting for virtually all syntactic differences commonly found in normal speech. Many of the variables investigated by previous researchers are subsumed by Chomsky's model, which includes not only such constituents as nouns, verbs, adjectives and tense, but a large number of syntactic variables not previously investigated. This dissertation will attempt to use Chomsky's model to investigate the syntactic diversity accompanying the verbal description of different emotional states.

CHOMSKY'S SYNTACTIC THEORY

Chomsky's theory is a syntactic theory and restricts itself to this level under the assumption that the syntactic component "constitutes its [language's] sole 'creative' part (1965, p.136)", with the semantic and phonological component being "purely interpretive, playing no part in the recursive generation of sentence structures (p. 141)". Quite apart from arguments about whether variation in pronunciation or the interpretation of meaning is creative, it is clear that differences in the type of constituents and the relationship between elements make up a significant part of what are commonly considered "stylistic" differences (at least by linguists, psychologists, and psychiatrists), and both of these areas belong to the syntactic component. For Chomsky, this component, which contains both base and transformational subcomponents, consists of a system of rules which assign structural descriptions to sentences.

At the base level, an ordered set of phrase structure rules assign category symbols (S, NP, V, etc.) to constituents and generate a labelled tree diagram. A terminal string is formed by inserting lexical items (i.e., words) into this tree diagram, thus completing the deep structure. The deep structure represents the formal, abstract content of a sentence and contains all the information necessary for a semantic interpretation. According to Chomsky's model, the deep structure is mapped by transformational rules into a surface structure, which, after phonetic interpretation, produces the sentences we speak and hear.

Grammatical transformations consist of an ordered set of structural changes which apply to the deep structure and the output of previous transformations whenever the structural description is met, often reordering elements in various ways in the course of their application. Transformations are divided into two general classes, optional and obligatory. Obligatory transformations must be applied whenever the structural descriptions are the same. For this reason, their probability of occurrence is unity and the only contribution they make to stylistic differences is that their omission produces ungrammatical sentences. Optional transformations, on the other hand, may be either applied or omitted and affect purely "stylistic" changes.[3] One example is the passive transformation.[4] If applied, the sentence is changed from its active to its passive form (e.g., "John likes Mary." is changed into "Mary is liked by John."); omitting it leaves the sentence in its active form.

As has frequently been noted (e.g., Green, 1972; Derwing, 1973), Chomsky's model, particularly Chomsky's definition of linguistic competence, is open to a number of different interpretations. While two different interpretations, a strong and a weak version, are usually made, at least three seem necessary in order to capture all the nuances of the term competence. The strongest claim and the one adopted by Chomsky himself is that the transformational model represents the true schema present in all humans. This schema is innate, universal and species specific, and accounts for the rapid learning (i.e., acquisition) of language by children. For those who adopt this view, Chomsky's model is not seen as just another grammatical description like any other grammatical description, but a descriptive model with special status due to its naturalness and simplicity and its ability to account for the actual processes used in the acquisition and construction of sentences during speech.

A second view is a process view, which though still strong is considerably weaker than the claim that Chomsky's model represents the innate universal language schema present in all humans. According to this second view, no innate nor universal grammar exists. The child acquires language skills not through a data processing model (i.e., storing and retrieving specific sentences), but by capturing generalized principles (i.e., an abstract system of rules) in the language presented to him. For example, after repeated exposure, he learns that sentences contain noun phrases and verb phrases (i.e., $S \longrightarrow NP + VP$), that adjectives are often preceded by adverbs (i.e., $AP \longrightarrow (Adv)A$), and that nouns are sometimes preceded by determiners (i.e., $NP \longrightarrow (D)N$). In formulating such rules, it is assumed that each rule tends to proceed toward greater and greater simplicity; therefore, something approaching a transformational grammar represents the final product likely to occur in the internalized systems of many people.[5]

The weakest claim and the one accepted by even the critics of Chomsky's model (e.g., Derwing, 1973) is that the model is not present explicitly, nor demonstratively present implicitly, during the acquisition or production of sentences, but it nevertheless meets Chomsky's own (1964) second criterion for descriptive adequacy, i.e., it "specifies the observed data in terms of significant generalizations that express underlying regularities in the language (p.63)." In other words, no claim is made about the internalized system, but the model is descriptive of the output of that system (i.e., language).

The important point, for the present work, is that no matter which view of Chomsky's model is adopted, the model remains a useful means for analyzing and describing the sentences produced, since it can be used as a descriptive device which works backwards from sentences already formed to provide a structural description and a transformational history for those sentences. Anyone familiar with the model and given a precise list of rules can sketch a tree-diagram, tabulate selection among phrase structure rules, and trace the transformational history of a given sentence, and because of the specificity of the rules, agreement between different individuals analyzing the same data is likely to be very high.[6]

Although other linguistic models, for example, the generative semantic model of Lakoff (1971) and McCawley (1966) or Fillmore's (1968, 1969) case grammar, might have been used in a similar way, Chomsky's model has the advantage of limiting itself to the more easily identified syntactic component and providing sufficiently fine discriminations to account for the smallest constituent differences in category symbols. A grammatical description staying closer to the surface (Harris, 1970) was also considered, but Harris's model lacks the discriminative capacity of Chomsky's model because it currently groups all constituents under rather molar categories (i.e., Noun Phrase, Verb Phrase, Prepositional Phrase, etc.) with no provisions for smaller categories. Furthermore, most other linguistic theories have simply not been developed to the same extent as Chomsky's has been developed by himself and others. Both Generative Semantics and Case Grammar have been derived from Chomsky's model in attempts to take care of some problems not previously covered. Some of these improvements, such as Katz and Postal's (1964) sentence morphemes, have simply been reincorporated into Chomsky's original model, producing what has come to be known as the post-Aspects model (Aspects ... being the title of Chomsky's 1965 book). A derivation of this post-Aspects model will be used in the present study.

The model used in the present study has been expanded to include sentence structures not previously included in published accounts of Chomsky's model. These include unacceptable deviations, such as frontal conjunctions, incomplete sentences, word and phrase omissions, etc., which occur quite often in common speech and must be described and accounted for if the experiment is not to exclude a large proportion of the data. To be complete, every sentence, whether grammatical or not, should be described and the basis for its ungrammaticalness (which may be an important variable itself) specified. Most of these disturbances are treated in a way similar to transformations, i.e., they are described in terms of a structural description followed by a structural change, which inserts or deletes items and constituents. Unlike phrase structure and transformational rules, grammatical errors are part of the speaker's performance, not aspects of his underlying competence.[7] Four such additional rules were necessary to account for the errors encountered within the protocols of subjects used in the present experiment. These additions represent formal descriptions for what Mahl (1959) has called "speech disturbances", and account for all but two of Mahl's seven categories.

EMOTIONS AND EMOTIONAL DIMENSIONS

Emotions, in the present study, will be treated in two ways, which reflect the current division among theorists who deal with emotions.[8] The first group (Allport, 1924; Woodworth, 1938; Plutchik, 1962; Tomkins & McCarter, 1964; Osgood, 1966; Frijda, 1970; Izard, 1971) describe emotions in terms of a basic set of primary emotions, more complex emotions being formed by combinations of primary emotions. Differences in the expression of primary emotions will be one of the main variables investigated in the present study. Though drawn from different research designs and theoretical approaches, there has been general agreement on six primary emotions: happiness, sadness, fear, anger, surprise, and disgust. All of the more recent investigators (i.e., all but Allport and Woodworth) have found an interest category and Plutchik has postulated an additional acceptance category, which seems to be closely related to Allport's "attitudinal group" and Woodworth's "love" category (Woodworth includes love and happiness in the same category). Part of the reason that acceptance, which seems the logical opposite of disgust, has not been included as a primary emotion by other investigators is that many of these researchers have derived their primary categories from facial expression data and acceptance is a difficult emotion to communicate facially (a phenomenon recognized as early as 1872 by Darwin). From the resulting list of eight emotions, seven were chosen for the present study:

(1) Happiness	(5) Liking, acceptance of
(2) Sadness	(6) Disgust, dislike of
(3) Fear	(7) Interest, curiosity in
(4) Anger	

Surprise was omitted because of its transient nature which causes it to change immediately into something else and makes it difficult to describe.

The second group of theorists, starting with Wundt (1896) and later Schlosberg (1952, 1954) have been more interested in representing emotions as single points along continuous dimensions or scales. These investigators have been far less successful in reaching an agreement about what these dimensions are. Schlosberg (1952) initially listed two dimensions, pleasantness-unpleasantness and attention-rejection, but later (1954) added a third, sleep-tension. Osgood (1966) listed four: pleasantness-unpleasantness, activation, control, and interest. Other theorists, for example Frijda (1968, 1970) who postulates a hierarchical model, have found a great many more.

To avoid choosing between the various theories or arbitrarily selecting one to the exclusion of all others, the present investigator selected 12 bipolar dimensions either found or postulated by previous theorists and asked 100 Introductory Psychology students to rate each of the seven primary emotions along these 12 dimensions. A factor analysis (with varimax rotation) was done on the resulting data, yielding two dimensions that consistently grouped together as independent factors:

1. Evaluation

11. Intentionality

The evaluative dimension was made up of two scales -- pleasant-unpleasant and good-bad. The intentionality factor consisted of three separate scales -- intentional-unintentional, deliberate-impulsive and controlled-unrestrained. (A brief description of this antecedent study is given in Appendix A).

Due to the choice of emotions used (i.e., all selected for their moderate intensity), a strength or intensity dimension failed to show up as an independent factor, even though it has been consistently found by a large number of previous researchers (Wundt, 1968; Schlosberg, 1954; Plutchik, 1962; Osgood, 1966; Frijda, 1968) and has a status almost equivalent to that of the evaluative dimension. In order to assess syntactic differences in this important dimension, the subjects themselves were asked to rate the strength of each emotional experience described and differences in the relative strength of each experience were used to analyze differences within the strength dimension.

In addition to differences among emotions and between bi-polar ends of the dimensions used, differences between general and specific descriptions were also analyzed. This is not a dimension of emotion per se, but a distinction between two modes of discourse, which roughly parallels the distinction between abstract and concrete. Specific descriptions are concrete descriptions. They are based on recall and description of actual events in one's past in which one has felt the emotion being described. General descriptions are abstract. They are attempts to generalize from the specific effects of isolated experiences to general statements which cover all cases.

The generality of the present findings is greatly extended by including both specific and general descriptions in the current analysis, since syntactic differences between these two modes of discourse can be compared. If the study had been limited to specific descriptions only, then it would not be possible to infer that the same syntactic differences occur when a person becomes more abstract. But if both types of descriptions are obtained and compared, then differences can be analyzed, and, if no interaction occurs with the other variables tested, then the differences found among emotions and within emotional dimensions can be assumed to be independent of the type of discourse used to describe these experiences.

APPROACH

Because previous studies have not dealt with either the range of emotions or syntactic variables used in the present study, no specific predictions were made on the basis of this research. The strategy adopted was to apply Chomsky's model (somewhat blindly), catalogue differences that do occur (in a typical "pre-scientific" manner), and then proceed from differences actually present in the data to empirical generalizations and, possibly, theoretical conjectures pertaining to their causes. The only assumption made was that differences in expression probably exist, because the experiences themselves differ and syntax appears to be an important organizational feature underlying the recall and description of these experiences.

METHOD

Twenty participants were asked to describe both a specific and a general instance of the seven primary emotions: happiness, sadness, fear, anger, liking, dislike, and curiosity. Syntactic differences between specific emotions and emotional dimensions were then analyzed according to the criteria explained in the section describing syntactic variables.

SUBJECTS

Twenty-Nine volunteers from Introductory Psychology classes took part in the experiment in order to receive course related credits. Six subjects were dropped from the sample because they were unable to carry out the procedures as instructed. Three of these alternated between specific and general descriptions, giving a specific description for one emotion, then a general description for the next. Two others were unable to complete the full task; one was unable to think of a specific incident of liking; the second was unable to remember a time when he had felt anger. The final deleted subject was dropped because he complicated the task by linking multiple terms for emotions on the same card, e.g., the card reading "disgust, dislike of" was interpreted as dislike of disgust, "interest, curiosity in" was seen as curiosity in (someone else's) interest. Three other subjects were dropped because their descriptions, which were often limited to one or two sentences, were too short to be analyzed.[9] With these deletions, 20 subjects were left, 10 males and 10 females, and the protocols of these 20 subjects were used for the current analysis.

PROCEDURE

Each subject was asked to recall a time when he felt the various emotions and then to describe this experience in as much detail as possible. Following this, he was asked to use this experience and others like it to describe in a more general way what it felt like when he experienced this emotion. The seven emotions used in the present study were presented on a deck of seven cards, arranged in random order. Subjects were instructed to turn over each card, one at a time, and describe both a specific incident and their general experience before going on to the next card. The actual instructions given to the subjects were as follows:

> This is an experiment in emotions. I'm interested in finding out how you experience various emotions and how emotions affect you in "real life" situations. In order to get at your real life experience, I'm going to ask you to recall a time when you felt various emotions and then describe this experience in as much detail as possible. Following this, I would like you to describe these emotions in a more general way. The emotions I want you to describe will be given on a small deck of seven cards, arranged in random order. Please, turn each card over, one at a time, and describe both a specific instance and your general experience before going on to the next card. Pause between cards to give yourself a chance to relax. In describing your experience, you will be talking directly into a microphone and I will be taping your descriptions in the other room. You needn't identify yourself and I won't identify you when decoding your conversation. Needless to say, your descriptions will be kept strictly confidential. Take as long as you like to recall each experience. There is no time limit on any of the talks, but I would like you to be as spontaneous as possible -- say the first thing that comes to mind. And talk for as long as you like. Obviously, the more pertinent information you give me, the more material I will have to work with.

> To help you with the procedure, I've made up a set of instructions [hand out instructions]. I would like you to read these instructions before turning over the first card and starting the experiment. If you have any questions or problems during the experiment, feel free to refer back to them.
> Are there any questions, now?
> Then I'll show you to your room.

In addition to these general instructions, which were given verbally, subjects were also given a set of typed specific instructions, which they took into the experimental room with them.

> Start from the top of the deck and turn one card over at a time. For each emotion:
> (1) Think of a specific incident in which you felt this emotion. Give yourself a few moments to relive this incident -- try to regain as much of the experience as possible. Then describe the events and your experience of these events in as much detail as possible.
> (2) After you have finished your description of a specific experience, use this experience and others like it to describe, in a more general way, what you feel when you experience this emotion.
> When you have finished, pause for a few moments, then go on to the next card. It is important that you be as spontaneous as possible in your descriptions -- avoid rehearsing what you are going to say and simply say whatever comes to mind. Please, tell what the emotion is and whether you are describing a specific or general experience before starting each description. When you have finished all seven cards, open your door and I will come in and tell you more about the study and what I hope to gain from it.
> (In order to give you a chance to warm up to the microphone, I would like you to reread these instructions aloud before going on to the first card. When you have finished, turn over the first card and start).

In describing their experience, participants talked directly into a microphone and their conversations were recorded and monitored in another room. To allow them to warm up to the tape recorder, they were asked to reread the specific instructions into the microphone before starting. After they had described all seven of the emotions used, they were then asked to rate the strength and vividness of each specific experience on a seven-point scale. No time limit was set, but the range of time taken by individual subjects varied from 20 to 80 minutes with a 50 minute average.

The experiment continued until 20 complete protocols had been collected. The taped conversations were then transcribed, analyzed, and tested for statistically significant differences.

THE DEPENDENT VARIABLE -- SYNTACTIC DIFFERENCES

The protocols were transcribed and stylistic differences between emotions and emotional dimensions were analyzed. In analyzing the data, differences among three sets of syntactic variables were tested: (1) phrase structure rules, which assign structural descriptions to the deep structure: (2) transformations, which change structural descriptions present in the deep structure and the output of preceding transformations by substituting, permutating and deleting elements: (3) errors in performance, which account for speech disturbances due to ungrammatical insertions and deletions, false starts, and sentence overlaps. Differences within each of these sets of variables were analyzed by dividing the actual occurrence of a given rule by the total number of times that it could have occurred.

Phrase structure rules

Phrase structure rules consist of an ordered set of rewrite rules which use category symbols to describe both dominance relations and the linear order of these symbols as they occur in the deep structure of a given sentence. Chomsky has suggested that, in spite of the unlimited number of sentences at the surface level, all sentences can be described in terms of a finite (actually very small) number of phrase structure rules at the deep structure level. Thirteen such rules were used in the present study and accounted for all sentence constructions -- both grammatical and ungrammatical -- found in the present data.

For brevity, abbreviations are used in listing the phrase structure rules, but these abbreviations are explained in the descriptions which follow. Parentheses represent optional categories which may or may not be present in the deep structure. Braces represent mutually exclusive choices, where selection of one constituent excludes selection of other constituents contained within the braces. The phrase structure rules themsleves are listed alphabetically, whereas the expansions of these rules into singular choices, which are the variables actually tested, are listed numerically and exemplified in the extended descriptions which follow. Only optional choices are listed in these extended descriptions. Obligatory expansions and redundant expansions inferable from other expansions are described but are neither listed nor exemplified.

Phrase Structure Rules

A. $$S \rightarrow (\text{Int}) \left(\left\{ \begin{matrix} \text{Conj} \\ \text{Conj adv} \end{matrix} \right\} \right) (\text{Sen Morp})\ NP + \text{Aux} + VP$$

B. $$\text{Sen Morp} \rightarrow \left(\left\{ \begin{matrix} Q \\ \text{Imp} \end{matrix} \right\} \right) (\text{Neg})$$

C. $$VP \rightarrow V\left(\left\{ \begin{matrix} \text{Pred} \\ NP \end{matrix} \right\} \right)(PP)(S)(ADV_i+)$$

D. $$\text{Pred} \rightarrow \left\{ \begin{matrix} AP \\ NP \\ PP \end{matrix} \right\}$$

E. $$ADV_i \rightarrow \left\{ \begin{matrix} ADV_{time} \\ ADV_{place} \\ ADV_{manner} \\ ADV_{purpose} \end{matrix} \right\}$$

F. $$\left\{ \begin{matrix} ADV_{time} \\ ADV_{place} \\ ADV_{manner} \\ ADV_{purpose} \end{matrix} \right\} \rightarrow \left\{ \begin{matrix} AP \\ NP \\ PP \end{matrix} \right\}$$

G. $$NP \rightarrow \left\{ \begin{matrix} (NP)\ S \\ (D)(AP)\ N\ (\text{Comp}) \end{matrix} \right\}$$

H. $$D \rightarrow (\text{Pre-det}) \left\{ \begin{matrix} \text{Art} \\ \text{Dem} \\ \text{Gen} \end{matrix} \right\}$$

I. $$AP \rightarrow (\text{Adv})\ A\ (\text{Comp})$$

J. $$\text{Comp} \rightarrow \left\{ \begin{matrix} S \\ AP \\ PP \end{matrix} \right\}$$

K. $$PP \rightarrow P + NP$$

L. $$\text{Aux} \rightarrow T\ (M)(\text{Perf})(\text{Prog})(\text{Incho})$$

M. $$V \rightarrow Vs\left(\left\{ \begin{matrix} \text{Prt}_1 \\ \text{Prt}_2 \end{matrix} \right\} \right)$$

Prt_1 = moveable
Prt_2 = nonmoveable

N. $$T \rightarrow \left\{ \begin{matrix} \text{Past} \\ \text{Present} \end{matrix} \right\}$$

A. Rule A states that each sentence (S) must contain a noun phrase (NP), an auxiliary (Aux), and a verb phrase (VP). In addition to these, it may but need not contain a sentence morpheme (Sen Morp), which marks the sentence as a question, imperative or negative and triggers an obligatory transformation which changes the designated deep structure into a surface sentence of the corresponding type; a frontal conjunction (Conj), such as and or but; or a conjunctive adverb (Conj adv), such as so; or an interjection (Int), which is simply a word (e.g., Well) or a parenthetic clause (e.g., You know) used to introduce or comment on a sentence but not contributing to the semantic content of the sentence itself. Both frontal conjunctions and frontal adverbs are distinguished from internal conjunctions resulting from conjoined sentences by the length of the pause preceding them and the relationship of the sentence that they introduce to the preceding sentence.

Interjections, frontal conjunctions, and frontal conjunctive adverbs are not included in Chomsky's model because they are neither grammatical nor acceptable[10] and seem to be based, at least partly, on performance aspects of the language (the actual use of language in concrete situations) rather than linguistic competence (the ideal speaker-hearer's knowledge of his language). Chomsky is concerned only with competence. But these deviations occur quite frequently in natural speech and a descriptive model must account for them if it is not to omit a large part of the data.

In addition to the obligatory expansion into a noun phrase, auxiliary and verb phrase, phrase structure rule A allows the following structures:

1. Int e.g., Well, it was hard to find.
2. Conj But he went there anyway.
3. Conj adv So we drove on to Seattle.

It also allows a sentence morpheme but this expansion is redundant since it can automatically be inferred from the next rule.

B. A sentence morpheme, when present, contains either a question marker (Q) or an imperative marker (Imp) and/or a negative morpheme (Neg). Due to Katz and Postal's (1964) assertion that transformations cannot change meaning, which was later adopted by Chomsky (1965), the concept of sentence morpheme was introduced in order to distinguish questions, imperatives, and negative sentences from their unmarked affirmative, declarative counterparts. Q triggers an obligatory transformation which rearranges the underlying structure into the surface form of a question. Imp triggers a transformation which yields a command. Neg provides for the placement of a negative morpheme within the sentence. The rule is structured so that the choice between Q and Imp is mutually exclusive, i.e., a sentence cannot be both a question and command simultaneously. But Neg may occur with either, forming a negative question (Aren't you hungry?) or a negative command (Don't touch that wet paint!).

Rule B allows three separate expansions, i.e.,

4. Sen Morp → Q e.g., Did you close the window?
5. Sen Morp → Imp Close the window!
6. Sen Morp → Neg You did *not* close the window.

C. A *verb phrase (VP)* must contain, at the very least, a verb. The verb may occur alone as an intransive verb (Vint) or with a combination of other constituents. If the verb is transitive, it must contain at least a noun phrase (NP), which may, but need not, be followed by any and possibly all of the following constituents: a prepositional phrase (PP), an embedded sentence (S), and any number of adverbial phrases (ADV_i+). If the verb is copulative (i.e., *be*) or any one of the other verbs behaving as a copulative verb (e.g., *seem*, *become*) then it is followed immediately by a predicate (Pred). Only the choice between the Pred and the NP is mutually exclusive and Pred, like NP, can be followed by a PP, a S, and/or any number of adverb phrases. The inclusion of S within the VP is one way of introducing recursion into the system and allowing a single matrix sentence to contain an unbounded set of embedded sentences. This recursion also occurs with noun phrases (rule G) and complements (rule J).

Rule C allows the following expansions, each dominated by VP (rules 8-13 also contain an obligatory V preceding each element on the right, which is omitted for brevity):

7. VP → Vint e.g., We *ate*.
8. VP → Pred Ché Guevara was *a revolutionary*

9. VP → NP e.g., Justin likes apple pie.

10. VP → PP Mark gave flowers to Mary.

11. VP → S She asked him to give her candy.

12. VP → ADV_i They went to the park.

13. VP → $\mathrm{ADV}_i +$ They left the park sometime later.

Though rule 13 could be expanded indefinitely, it is used here to include all cases in which two or more adverbial phrases occur within the same sentence.

D. A predicate can be an adjective phrase (AP), a noun phrase (NP) or a prepositional phrase (PP). The choice between these three is mutually exclusive.

14. Pred → AP e.g., W.C. Fields was (very) funny.

15. Pred → NP He was a comedian.

16. Pred → PP Goddard College is in Vermont.

E. Adverbial phrases are adverbs of time, place, manner, or purpose:

17. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_{time}$ e.g., Mark and Maribell met yesterday.

18. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_{place}$ They drove to Regina.

19. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_{manner}$ He drove (very) carefully.

20. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_{purpose}$ He ran out of gas on purpose, because ....

In the deep structure, adverbial phrases occur at the end of the sentence, but these can be shifted to an internal position or even a frontal position by an adverb movement transformation.

F. An adverbial phrase, of any type, consists of an adjective phraise, a noun phrase, or a prepositional phrase.

21. ADV → AP e.g., He drove *carefully*.

22. ADV → NP He met her *yesterday*.

23. ADV → PP He left her *in town*.

There are no co-occurrence restrictions on the type of adverbial phrase (i.e., time, place, manner or purpose) and the type of expansions of these adverbial phrases into AP, NP, and PP.

G. A *noun phrase* consists of either a sentence, possibly preceded by another noun phrase, in which case the sentence will be a relative clause, or a simple noun possibly preceded by a determiner (D) and/or an adjective phrase (AP) and followed by a complement (Comp). In most post-*Aspects* models, adjective phrases do not precede nouns. They are formed from relative clauses by permuting and deleting transformations. They are included here for ease of tabulation and serve the same purpose as tabulating an optional adjective fronting transformation.

Rule H expands into six separate rules:

24. NP → N e.g., *Jack*, *dogs*, *houses*, etc.

25. NP → *D* + N *the* dog(s), a house, etc.

26. NP → *AP* + N *big* dogs, *old* houses, etc.

27. NP → N + *Comp* the fact *that John is overbearing*

28. NP → S *That John is overbearing* is a fact.

29. NP → *NP + S* *John who is overbearing* ....

Complements are reserved for cases that cannot be derived from relative clauses through deletion transformations, i.e., cases in which no coreferential NP occurs in the following sentences. Cases with coreferential NP's are treated as relative clauses (Chomsky, 1970).

H. A determiner is an article (A), a demonstrative (Dem), or a possessive (Gen). The choice is mutually exclusive. In addition to one of these, it may also contain a pre-determiner, (Pre-det) which can co-occur with any of the above. Like adjectives before nouns, possessives are usually derived from relative clauses by permutation and deletion transformations. Again, for descriptive purposes, it makes no difference whether a genetive is counted or an optional transformation is tabulated.

Rule I expands into four separate rules:

30. D ⟶ Art e.g., a, an, the
31. D ⟶ Dem this, that, these, one, some, etc.
32. D ⟶ Gen my, yours, John's, etc.
33. D ⟶ Pre-det + ... some of the people, both of our dogs

I. Adjective phrases contain adjectives (A) possibly modified by an adverb (Adv) and/or a complement (Comp).

34. AP ⟶ A e.g., John was mad.
35. AP ⟶ A + Comp John was mad as hell.
36. AP ⟶ Adv + A John was very mad.

[illegible]. A complement is a sentence (S), an adjective phrase (AP), or a prepositional phrase (PP).

37. Comp ⟶ S e.g., The fact that Mary is lovely is obvious.
38. Comp ⟶ AP Joan likes somebody else.
39. Comp ⟶ PP Helen did her graduate work at the University of Massachusetts

K. A prepositional phrase is made up of a preposition (P), such as to or for and a noun phrase (NP). No options are allowed, so no expansions are necessary.

L. The auxiliary (Aux) contains an obligatory tense marker (T), which is later expanded to past or present. In addition to this it may, but need not, contain one or all of the following elements: a modal (M), a perfect aspect (Perf) (i.e., have + en), a progressive aspect (Prog) (i.e., be + ing), and/or an inchoative aspect (Incho) which behaves in a manner similar to the progressive aspect but marks the presence of verb forms such as start, begin, etc. Each of the aspects, perfect, progressive and inchoative, both add an element to the deep structure and a suffix to the element immediately following, whether this is a verb or another aspect.

40. Aux → M e.g., I will talk to him. (can, could, etc.)

41. Aux → Perf He has seen the error of his ways.

42. Aux → Prog John and Mary are having an argument.

43. Aux → Incho Allen starts teaching this fall.

Each of the elements on the right side of the above expansions is preceded by an obligatory tense marker (T), which has been deleted for brevity. The linear relationship between auxiliary elements when more than one occurs at the same time is the same as the left-to-right order of rule L, i.e., modal first, followed by perfect, progressive, then inchoative or any combination of the above four.

M. Verbs (V) may occur alone or as verb stems (Vs) with moveable or nonmoveable particles (Prt_1 and Prt_2, respectively).

44. $V \longrightarrow Vs + Prt_1$ e.g., He took out the trash.
He took the trash out.

45. $V \longrightarrow Vs + Prt_2$ He went out to look for a job.

Whether a particle is moveable or not is determined by the context in which it occurs and it is possible for the same particle to be moveable in one context but nonmoveable in another. Because the frequency of verbs without particles, which is by far the most common case, can be calculated by subtracting the frequency of the above two rules from the total number of sentences, a separate rule was not included to account for the occurrence of verbs alone.

N. The verb tense (T) is either past or present.

46. $T \longrightarrow Past$ e.g., He ran home from school.

Though phrase structure rule N actually expands into two separate rules, $T \longrightarrow Past$ and $T \longrightarrow Present$, the latter is redundant since it can automatically be inferred from the former.

Again, it should be stressed that these 46 rules denote optional choices and optional choices only. Obligatory expansions, such as,

$$S \longrightarrow NP + Aux + VP$$

$$PP \longrightarrow P + NP$$

$$Aux \longrightarrow T$$

are not included, since their frequency of occurrence is always unity (i.e., 100%). For brevity, specific combinations are not included. To do so would be to increase the number of rules beyond the number that could be easily counted, while at the same time decreasing frequency of occurrence in each category. For example, rule C expands into seven separate rules (7-13), but if all combinations of rule C were specified, 36 separate rules would be needed, each occurring with only a small fraction of the percentage of occurrence in the above seven.

The frequency of occurrence for each rule is calculated by dividing its actual occurrence by the number of times that it might have occurred, i.e., dividing the number of times that an optional element on the right in a phrase structure rule occurs by the frequency of occurrence of the dominating node to the left. For example, the proportion of verb phrases containing predicates is calculated by dividing the number of predicates by the number of verb phrases (i.e., by the number of sentences, since each sentence has one and only one verb phrase).

In addition to the basic list of 46 rules, the total number of sentences in a given protocol (# Sent) and three composite measures were also recorded:

1) The proportion of embedded sentences (Semb) -- which was calculated by dividing the sum of all rules in which recursion was possible (i.e., 11, 28, 29, and 37) by the total number of sentences (both matrix and embedded).
2) The average number of adverbial phrases per sentence (ADV_1) -- which was calculated by dividing the total number of adverbial phrases by the total number of sentences.

3) The average amount of auxiliary modification (Aux) -- which is simply the sum of rules 40 through 43.

These measure combine the specific frequency of related phrase structure rules to obtain an overall average for a given category.

Transformations

Grammatical transformations consist of a structural description (SD), which lists the context and relevant aspects to be changed, and a structural change (SC), which through substitutions, permutations, and deletions shows how the change occurs. In addition, they often contain additional limiting conditions (Cond), which restrict their application to a greater degree than is specifiable in the SD, alone. Though normally ordered because succeeding transformations often feed off the output of previous ones, the following list is only partially ordered because the object of this study is to simply count the optional transformations that do occur, not trace the entire transformational history. Because obligatory transformations must apply and play no part in stylistic variations, only optional transformations will be scored.

The total number of transformations needed to account for all English sentences has yet to be established. Chomsky (1957) includes an exemplary list of just over a dozen. Burt (1971), in a book devoted entirely to transformations, lists 26 (eight of which are optional) with a few rather obvious omissions, such as conjunction and particle movement. After incorporating two optional transformations, possessive and adjective shift, into the previous phrase structure rules, 12 transformations were necessary to account for all stylistic variations found in the present study. (Letters U-Z represent an unspecified, possibly null, string of constituents).

Transformational Rules

1. Particle movement

SD:	${}_S[$ X	${}_V[$ Vs +	Prt$_1$ $]_V$	NP	Y $]_S$	
SC:	1	2	3	4	5	→
	1	2	0	4+3	5	

2. Passive

SD:	NP	X	V	NP	
SC:	1	2	3	4	→
	4	2+be+en	3	by+1	

Cond: 1 ≠ 4

3. Agent deletion -- following passive

SD:	NP	X	be+en	V	by	NP	
SC:	1	2	3	4	5	6	→
	1	2	3	4	0	0	

Cond: 6 = dummy (from previous sentence) or pro-form

4. Conjunction

SD:	S_1	S_2	
SC:	1	2	→

$$1 \begin{Bmatrix}\text{Conj}\\ \text{Conj adv}\end{Bmatrix} 2$$

5. Constituent(s) deletion -- following conjunction

SD:	${}_S[$ U	V	W $]_S$	$\begin{Bmatrix}\text{Conj}\\ \text{Conj adv}\end{Bmatrix}$	${}_S[$ X	Y	Z $]_S$	
SC:	1	2	3	4	5	6	7	→
	1	2+4+6	3	0	0	0	0	

Cond: U = X and W = Z

6. Adverb movement

A. Fronting -- when X is null.

B. Internalization -- when X is not empty.

SD:	$_S[$ X	Y	ADV_1	Z $]_S$	
SC:	1	2	3	4	→
	1+3	2	0	4	

Cond: Y must be dominated by a major constituent.

X must be either dominated by a major constituent or empty.

7. Dative movement

SD:	V	NP	$_{PP}[$	$\left\{\begin{matrix}\text{To}\\ \text{For}\end{matrix}\right\}$	+	NP	$]_{PP}$
SC:	1	2	3	4		5	→
	1	5+2	0	0		0	

Cond: NP_5 must be an animate noun phrase

8. Complement insertion

A. that insertion

B. (for) + to insertion

C. possessive - ing insertion

SD:	$_{NP}[$ X	$_S[$ Y $]_S]_{NP}$	
SC:	1	2	obligatory →
	1	Comp+2	

9. There-insertion

$$\begin{array}{llllll}
\text{SD:} & {}_{NP}[\,V\,]_{NP} & \left\{\begin{matrix}\text{Aux} \\ {}_{Aux}[\,X\end{matrix}\right. & \begin{matrix}\underline{be}\\ \underline{be}\end{matrix} & \begin{matrix}W\\ Y\,]_{Aux}\end{matrix} & \left.Z\right\} \\
\text{SC:} & 1 & 2 & 3 & 4 & 5 \rightarrow \\
 & \underline{There} & 2 & 3+1 & 4 & 5
\end{array}$$

10. Clefting

$$\begin{array}{llllll}
\text{SD:} & {}_{NP}[\,X & S\,]_{NP} & Y & \underline{be} & Z \\
\text{SC:} & 1 & 2 & 3 & 4 & 5 \rightarrow \\
 & \emptyset & \underline{it} & 3 & 4 & 5+1+2
\end{array}$$

11. Wh- deletion

$$\begin{array}{lllll}
\text{SD:} & {}_{NP}[\,NP & {}_{S}[\,NP & NP & X\,]_{S}\,]_{NP} \\
\text{SC:} & 1 & 2 & 3 & 4 \rightarrow \\
 & 1 & \emptyset & 3 & 4
\end{array}$$

Cond: NP_2 dominates wh-pro form

12. Wh- be deletion

$$\begin{array}{lllll}
\text{SD:} & {}_{NP}[\,NP & {}_{S}[\,NP & \underline{be}+T & X]_{S}\,]_{NP} \\
\text{SC:} & 1 & 2 & 3 & 4 \rightarrow \\
 & 1 & \emptyset & \emptyset & 4
\end{array}$$

Cond: NP_2 dominates wh-pro.

1. Particle movement shifts a moveable particle from its position behind the verb to a position somewhere later in the sentence, for example,

He threw up his hands and walked out.

becomes He threw his hands up and walked out.

2. The passive transformation changes an active sentence into a passive one by reversing the positions of the deep structure agent and object, changing, for example,

The grooms fed the horses.

into The horses were fed by the grooms.

3. Agent deletion, which follows the passive transformation, erases the dummy or pro-form of a passive sentence, changing the above, for example, into,

The horses were fed.

4. The conjunctive transformation simply combines two separate sentences into a single sentence by linking them with a conjunction or a conjunctive adverb, forming a sentence like,

Carl reads Sartre and Carl reads Merleau-Ponty.

5. Constituent(s) deletion drops identical elements of conjoined sentences, lending considerable brevity to the language. The above now becomes,

Carl reads Sartre and Merleau-Ponty.

6. Adverbial movement shifts an adverbial phrase from its terminal or near terminal position (since it may be followed by other adverbs) to a position within the sentence or at the front. For example,

John saw a burglar by his house yesterday.

becomes, Yesterday, John saw a burglar by his house.(A)

or John saw a burglar yesterday by his house.(B)

The only restriction on this transformation is that adverbial movement is clause bounded and adverbial phrases cannot be moved to a position within a major constituent, for example, yesterday cannot be moved between a and burglar.

7. Dative movement shifts the noun phrase of a prepositional phrase to the indirect object position, while erasing the preposition.

John sent flowers to Mary.

becomes, John sent Mary flowers.

8. Complement insertion is not optional, but the choice of complements is to some extent.[12] An embedded sentence is changed into a complement by adding that, (for) + to, or a possessive + ing, changing a deep structure such as,

$_S$[John sings] disturbs me.

into: That John sings disturbs me.,

For John to sing disturbs me.,

and John's singing disturbs me., respectively.

9. There insertion puts a there at or near the head of the sentence and shifts the deep structure agent to the object position, leaving only a pseudo-agent in its place. For example,

A devil is among us.

becomes, There is a devil among us.

10. Clefting, like there insertion, moves the agent to the object position, but is restricted to the condition that the agent (i.e., the initial noun phrase in the deep structure) is a nominalized sentence. Thus,

That John is an idiot is obvious to all.

becomes, It is obvious to all that John is an idiot.

11. Wh- deletion drops the wh-pronoun (who, which, that, etc.) from a relative clause when this wh-pronoun is coreferential with the preceding noun phrase and is followed immediately by a noun phrase serving as the agent of the relative clause, reducing, for example,

The girl who(m) you saw yesterday was my sister.

to, The girl you saw yesterday was my sister.

12. Wh- be deletion drops the wh-pronoun and be from a relative clause reducing a sentence like,

Mark, who is the boy with red socks, is an English major.

to, Mark, the boy with red socks, is an English major.

Since an optional transformation may be either applied or omitted whenever the structural description is met, the frequency of occurrence for a given transformation can be calculated by dividing the number of times that a transformation occurs within a given protocol by the by the total number of times that the structural description for that transformation occurred. For example, since the passive can occur whenever a non-coreferential noun phrase occurs in the deep structure object position, the proportion of passive transformations can be calculated by dividing the actual occurrence of passives by the number of sentences with this structural description.

Grammatical errors

In addition to phrase structure differences and differences in the presence of transformational rules, which form two aspects of Chomsky's syntactic theory, a third set of variables was also tabulated, i.e., errors in performance or speech disturbances. The addition of these variables to those already listed seems important for two reasons. First, such errors occur quite often in natural speech and must be accounted for if the linguistic analysis of this speech is not to exclude a large part of the data. Secondly, errors of this type may occur differentially among emotions or within emotional dimensions and may turn out to be an important variable in differentiating different emotional states.

Four variables have been added to account for some of the commonly occurring deviations from grammatically adequate sentences: false starts, ungrammatical insertions and deletions, and sentence overlaps. The presentation of these variables is the same as that used to describe grammatical transformations, i.e., a structural description (SD), which lists the context and relevant aspects to be changed, is introduced and is followed by a structural change(SC), which through substitutions, permutations, and deletions shows how the change occurs. These rules represent formal descriptions for what Mahl (1959) has called "speech disturbances", and account for all but two (slips and stuttering) of Mahl's seven categories.

Grammatical errors

1. Ungrammatical insertions (ugi)

SD:	$_S[$ X	Y $]_S$
SC:	1	2
	1 + ugi	2

2. Ungrammatical deletions

SD:	$_S[$ X	Y	Z $]_S$
SC:	1	2	3
	1	∅	3

Cond: Neither Y nor Z can be empty.

3. False starts

SD:	$_S[$ X	Y $]_S$
SC:	1	2
	1	∅

Cond: Neither X nor Y are empty.

4. Sentence overlaps

SD:	$_S[$ W	X $]_S$	$_S[$ Y	Z $]_S$
SC:	1	2	3	4
	1	∅	∅	4

Cond: W, X, Y, and Z are all major constituents.

None can be empty.

1. Ungrammatical insertion is used to account for all instances where a speaker interjects an ungrammatical element, either an undiscernable word or comment or a standard pausitive (uh or ah) into what might be an otherwise grammatical sentence. Mahl (1958) sees such insertions as a sign of anxiety. If either X or Y is empty then the insertion is between sentences.

2. Ungrammatical deletion describes instances where an element or group of elements is dropped from a sentence. If X is empty, then the initial elements are dropped and the sentence is started in the middle. If Z was allowed to be empty then rules 3 and 4 could be collapsed and written as a single rule, but, since discrimination is more important than economy, they are written as separate rules.

3. False starts is used to account for instances where a sentence is not completed, i.e., where terminal elements necessary for a grammatical sentence have been deleted.

4. Sentence overlaps is used to describe a condition where one train of thought gives way to another, with the latter retaining and using some part of the previous incomplete sentence.

Since errors in performance can occur at any time during speech, their frequency of occurrence is calculated by dividing their total occurrence by the total number of sentences within a given protocol. In addition to a separate count of each of the above four rules, a composite measure was also obtained by summing each of the above into an overall measure of total errors.

RESULTS

The recorded descriptions of emotional experiences by individual participants were transcribed verbatim into written form. Transcripts were then analyzed according to the phrase structure rules, transformational rules and grammatical error designations described in the previous section. For the phrase structure rules, the relative frequency of occurrence of each item was calculated by dividing its actual occurrence by the number of times that it could have occurred. The relative frequency of each transformation was calculated by dividing the number of times that the transformation occurred by the number of times that the structural description for that transformation was met. Grammatical errors were tabulated by dividing the frequency of occurrence within a given protocol by the total number of sentences within that description. In addition to phrase structure rules, transformations, and grammatical errors, the total number of sentences and several composite variables were also tabulated in order to determine the relative frequency of embedded sentences and the average amount of adverbial and auxiliary modification.

After the relative frequency of occurrence for each item had been tabulated, the procedure used to analyze the resulting data was a method of gradual data reduction. Using this procedure, items occurring too infrequently for statistical comparison and items occurring with equal frequency in all contexts (i.e., not statistically different) were eliminated from a core of syntactic features which differ along one of the comparisons made. Crystal and Davy (1969) use a similar procedure and refer to those linguistic items which discriminate one context from another as "style markers". Those left over after the linguisticly significant features have been identified are called "common-core" items. Those items which make up the common-core are stylisticly neutral, occur with equal frequency in all context being studied, and, for this reason, contribute nothing in the way of discriminating one context from another. The main task of any syntactic or stylistic analysis seems to be the identification of style markers characteristic of the phenomenon or variable under consideration.

The first step in this procedure was the elimination of those items absent in a substantial number of protocols. When an item was missing from more than five percent of the protocls, it was dropped from the study. Being absent means that the basis for an option in which it could have occurred was not established, i.e., the dominating node for phrase structure rules and the structural description for transformations did not occur and so, no option was present. By this step, the phrase structure rules describing the expansion of complements.

$$\text{Comp} \longrightarrow \begin{Bmatrix} \text{S} \\ \text{AP} \\ \text{PP} \end{Bmatrix}$$

was eliminated, as were six transformations,

(1) Particle movement
(2) Constituent deletion after passive
(3) Dative movement
(4) Complement insertion
(5) Wh- deletion
(6) Wh- be deletion

For all of these rules, the actual occurrence of a dominating node or a structural description necessary for the rule to apply was very infrequent and exceeded the five percent cutoff. This low frequency of occurrence prevents a meaningful statistical analysis. Complementation, for example, which accounted for the elimination of the one phrase structure rule and one set of transformations (actually six rules altogether), occurred, on the average, in only five percent of the noun phrases and two percent of the adjective phrases and twenty percent of the protocols contained no form of complementation whatsoever. The infrequency of conditions necessary for particle movement and constituent deletion after passive was even more pronounced. Slightly more than one percent of the verbs contained moveable particles and two-thirds (66%) of the protocols contained no moveable particle at all. Similarly, only one percent of the sentences were in the passive form and passives failed to occur in 77 percent of the descriptions. Both the absence of conditions necessary for these transformations and the low frequency of occurrence when conditions were met reduces the utility of these variables as indicators of emotional states.

After this preliminary elimination of items occurring too infrequently for statistical analysis, the second step was the use of statistical procedures to separate the linguisticly significant style-markers, whose relative frequency of occurrence significantly differed from one context to another, from those items belonging to the common-core, which occurred with equal or near equal frequency in all contexts.

To do this, six separate comparisons were made. A complete factorial design was used to compare differences between discrete emotions and mode of discourse (i.e., general verses specific descriptions), yielding two main effects and the interaction between these main effects. Following this, a one-way analysis of variance was used to compare differences between bipolar ends of each of the three dimensions: (1) evaluation, (2) intentionality, and (3) strength.

In order to enhance organization and easy reference, a separate section will be used for each of the comparisons made. For brevity and order of presentation, only significant differences are shown in the body of the text. Complete tables showing means and F-scores for all dependent variables, both style markers and common-core items, are given in Appendix B. Tables within the text are labelled in numerical order, whereas the corresponding complete table in Appendix B is given the same numerical title but preceded by a "B".

DIFFERENCES AMONG DISCRETE EMOTIONS

Because of the large number of variables tested, a conservative error measure was used to test the significance of differences among emotions and between modes of discourse. Instead of a pooled error term derived from the summation of all higher order interactions, a within error term based on the specific comparison being made was used. Such a procedure serves to limit the number of variables reaching significance and reduce the possibility of a variable reaching significance by chance alone (type 1 error).

Of the 59 variables tested, 19 were found to occur with significantly different frequencies within descriptions of the seven emotions tested. These differences included sentence length, all three composite measures, 13 phrase structure rules, one transformation and one grammatical error designation. The means and _F_ scores for these variables are listed in Table 1. To facilitate a point to be made later, these emotions are listed according to their rank on the evaluation dimension, with the most pleasant emotion (i.e., happiness) listed first and the least pleasant emotion (i.e., disgust) listed last.

Though not very meaningful in themselves, the _F_ scores in Table 1 show that the syntactic structures of descriptions of different emotional experiences do differ in a number of ways. The descriptions vary in length, in the number of embedded sentences, and in the amount of adverbial and auxiliary modification. They also vary in the amount of negation used, the types of adverb phrases and predicates, the relative frequency

Table 1

Means and F Scores for Syntactic Variables Significantly Differing Among Emotions, with Emotions Ranked Along the Evaluation Dimension

Syntactic variables	Means for emotions							F score
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
1. #Sent	39	32^a	31^a	39	44^b	44^b	42	2.76^*
Composite variables								
2. S_{emb}	$.48^a$	$.48^a$	.51	.54	.54	.54	$.58^b$	2.61^*
3. $\overline{ADV_1}$	$.48^a$	$.48^a$	$.47^a$	.56	$.61^b$	$.63^b$	$.64^b$	7.33^{**}
4. $\overline{AUX}$	.16	$.14^a$	.18	.19	$.22^a$	.16	.17	2.47^*
Phrase structure rules								
5. Sen Morp → Neg	$.04^a$	$.07^a$	$.06^a$	$.11^b$	$.10^b$	.09	$.12^b$	5.28^{**}
6. VP → V_{int}	.05	$.03^a$	.04	$.03^a$	$.05^b$	$.07^b$	$.02^a$	4.06^{**}
7. VP → Pred	$.36^b$	.29	$.27^a$	.30	.28	$.37^b$	.28	2.77^*
8. VP → NP	$.27^a$	$.39^b$	.30	$.36^b$	$.28^a$	$.23^a$	.34	6.70^{**}
9. VP → PP	$.12^a$	.15	$.24^b$	.16	.16	.16	.19	4.03^{**}
10. VP → ADV_1+	$.09^a$	$.09^a$	$.08^a$	.13	.12	$.15^b$	$.16^b$	6.22^{**}

Table 1 (continued):

	Means for emotions							
Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	_F_ score
11. Pred → AP	.55	$.45^a$	$.63^b$	$.66^b$	.53	$.62^b$	.57	3.27^*
12. Pred → NP	.34	$.43^b$	$.27^a$	$.25^a$	.32	.28	.30	3.29^*
13. $ADV_1 \rightarrow ADV_p$	.10	$.07^a$	.09	.12	$.15^b$	.09	.11	2.80^*
14. NP → N	.62	$.66^b$	.62	.62	$.59^a$	.61	$.59^a$	3.88^{**}
15. AP → Adv + A	.16	.14	.15	.21	.14	.15	$.11^a$	2.28^*
16. Aux → Prog	.06	$.04^a$	$.08^b$	.06	$.08^b$	.05	$.05^a$	3.09^*
17. $V \rightarrow Vs + Prt_2$	.034	$.032^a$	$.054^b$	$.031^a$	$.055^b$	.036	$.059^b$	2.47^*
Transformations								
18. _There_ insertion	$.003^a$	.007	.005	.007	$.013^b$	.009	$.016^b$	2.25^*
Grammatical errors								
19. False starts	$.11^b$	$.12^b$	.07	$.06^a$	.08	.09	.09	2.21^*

$^*p < .05$

$^{**}p < .01$

^{a}Significantly less than the overall mean ($p \leq .05$)

^{b}Significantly greater than the overall mean ($p \leq .05$)

of adverbs of place, the number of unmodified nouns, the number of adjectives modified by an adverb, the proportion of sentences containing the progressive aspect, and the number of nonmoveable particles. Differences in the amount of there insertion and false starts also occurred.

In order to find out more specifically the syntactic structure characteristic of descriptions of each emotion, a separate analysis, similar to that suggested by Dunnett (1955), was used to test whether the relative frequency for an emotion on a given variable significantly differed from the overall mean for that variable. These differences are also shown in Table 1. Those significantly below the mean ($P \leq .05$) are designated with the superscript "a". A "b" is used to denote those scores which are significantly above the mean.

While these differences among discrete emotions are sometimes interesting and often quite pronounced, many of these differences also occur within the dimensions tested, particularly the evaluation dimension, and will become more meaningful when dimensional differences have been identified.

DIFFERENCES OCCURRING BETWEEN MODES OF DISCOURSE

As mentioned previously, the generality of the present results is extended by including both general and specific descriptions in the present analysis. Because the distinction between general and specific descriptions roughly parallels the distinction between abstract and concrete descriptions, syntactic differences between these two modes of discourse should reflect the grammatical differences between abstract and concrete speech. These differences are shown in Table 2.

Table 2 shows that specific descriptions are generally longer and contain more adverbial and auxiliary modification, whereas general descriptions contain more embedded sentences. Phrase structure differences between these two modes of discourse show that specific descriptions contain more frontal conjunctions, more intransitive verbs, more noun phrases within the verb phrase. The adverbial phrases are more likely to be adverbs of place and purpose and less likely to be adverbs of manner. These adverbial phrases are also more likely to be prepositional phrases. Adjective and noun phrase adverbial phrases are relatively rare. Nouns are more likely to be modified within the specific descriptions, particularly by determiners and adjective phrases. The expansion of a noun phrase into a sentence is less common. Adjectives, also, are more often modified in specific descriptions, particularly by adverbs. In keeping with the greater amount of auxiliary modification, specific descriptions contain more perfect and progressive aspects.

Table 2

Means and F Scores for Syntactic Variables Significantly Differing for Mode of Discourse

	Modes of discourse		
Syntactic variables	Specific	General	F scores
1. #Sent	49	29	34.14^{**}
Composite variables			
2. S_{emb}	.50	.55	3.68^{*}
3. $\overline{ADV}_i$	.58	.53	7.76^{**}
4. $\overline{AUX}$	.19	.16	8.56^{**}
Phrase structure rules			
5. Conj.	.04	.02	10.77^{**}
6. $VP \rightarrow V_{int}$	.05	.04	4.50^{*}
7. $VP \rightarrow Pred$	.29	.34	12.15^{**}
8. $VP \rightarrow NP$	.34	.29	7.78^{*}
9. $VP \rightarrow S$	.18	.22	4.83^{*}
10. $ADV_i \rightarrow ADV_p$	.15	.05	46.55^{**}
11. $ADV_i \rightarrow ADV_m$	.44	.57	20.83^{**}
12. $ADV_i \rightarrow ADV_{pur}$	.09	.06	5.23^{*}
13. $ADV \rightarrow AP$	.40	.46	5.76^{*}
14. $ADV \rightarrow NP$	.28	.33	3.76^{*}
15. $ADV \rightarrow PP$	.31	.21	15.57^{**}
16. $NP \rightarrow N$	.58	.65	42.16^{**}
17. $NP \rightarrow D + N$	.24	.16	39.21^{**}
18. $NP \rightarrow AP + N$	.10	.06	17.71^{**}
19. $NP \rightarrow S$	.10	.12	11.50^{**}

Table 2 (continued):

	Modes of discourse		
Syntactic variables	Specific	General	*F* scores
20. AP → A	.81	.85	5.06^{*}
21. AP → Adv + A	.18	.12	12.93^{**}
22. Aux → Perf	.04	.02	9.80^{**}
23. Aux → Prog	.07	.05	8.38^{**}
24. T → Past	.56	.08	137.64^{**}
Transformations			
25. Conjunction	.22	.18	6.86^{**}
26. Const. deletion	.54	.64	8.24^{**}
27. Adverb fronting	.15	.25	20.81^{**}
28. Adverb internal.	.22	.27	5.51^{*}

$^{*}p < .05$

$^{**}p < .01$

The verb tense occurring within specific descriptions was usually the past tense; the present tense was used almost exclusively in the general descriptions (though this last finding is somewhat confounded by the nature of the task, since subjects were asked to recall specific instances from their own past).

The differences in transformations show that, in addition to frontal conjunctions, conjunctions in general are more common in specific descriptions, but constituent deletion after conjunction is less common. Adverbs, though more common for specific descriptions, are less likely to occur in frontal or internal positions, i.e., they are more likely to remain in a position near the end of the sentence.

EMOTION TIMES MODE OF DISCOURSE INTERACTION

It might be expected that concrete descriptions would differ from abstract descriptions in a number of linguisticly significant ways, but what is to be hoped is that these differences based on mode of discourse do not interact with descriptions of individual emotions to produce a pattern that is jointly dependent on the type of emotion and the mode of discourse. In the absence of any such interaction, then the syntactic differences among emotions can be assumed to be similar for both general and specific descriptions. Significant interactions are shown in Table 3.

This table shows that there are five phrase structure rules in which the relative frequency obtained on a given emotion is not independent of the mode of discourse. No composite measure, transformation, or grammatical error showed any interaction effect. It should also be noted that of the five phrase structure rules showing some interaction effect, only two (1 and 5) have occurred previously among those variables that were significantly different for different emotions. The effect for the expansion of verb phrases into prepositional phrases seems to be due to the fact that prepositional phrases are more common in general descriptions of happiness, fear and disgust, whereas the reverse is true for the other emotions. The progressive aspect is greater or the same for specific descriptions of all emotions, except curiosity, where the progressive occurs more often in general descriptions.

Table 3

Means and F Scores for Significant Emotion Times Mode Interaction

Syntactic variables	Means for emotions							F score
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
Phrase structure rules								
1. VP → PP								
Specific	.11	.18	.24	.19	.11	.17	.16	3.41**
General	.14	.12	.24	.14	.21	.14	.22	
2. ADV$_i$ → AP								
Specific	.46	.41	.46	.34	.39	.36	.39	2.37*
General	.50	.36	.38	.46	.53	.53	.44	
3. D → Art								
Specific	.68	.59	.67	.65	.73	.55	.73	5.43**
General	.62	.77	.48	.63	.55	.72	.71	
4. D → Gen								
Specific	.17	.20	.17	.21	.15	.23	.11	2.34*
General	.16	.06	.18	.18	.23	.16	.11	
5. Aux → Prog								
Specific	.06	.06	.06	.10	.08	.07	.06	3.16*
General	.06	.03	.10	.03	.08	.03	.03	

*$p < .05$

**$p < .01$

On the whole, the two factors of emotions and mode of discourse seem to vary quite independently of each other. Since this is true for specific emotions, the same pattern can be assumed to be true for emotional dimensions, since these are simply new ways of grouping and analyzing specific emotions.

DIFFERENCES WITHIN THE EVALUATION DIMENSION

As mentioned previously, many of the syntactic differences occurring among descriptions of different discrete emotions seem to be related to the position of these emotions on the evaluation dimension. To test further syntactic differences between descriptions of unpleasant emotions, these emotions were rated along the evaluation dimension and a mean-split[13] was used to divide the seven discrete emotions into two groups: (1) pleasant emotions, consisting of happiness, liking and curiosity, (2) unpleasant emotions, consisting of anger, fear, sadness, and disgust. A one-way analysis of variance was done on the resulting data. Significant differences within this dimension are shown in Table 4.

Table 4 shows that descriptions of unpleasant emotional experiences are longer; and contain more embedded sentences, more adverbial and auxiliary modification, more negation, and more cases of multiple adverbial phrases. They also contain a greater number of noun phrase predicates, more sentences acting as noun phrases, and more modals. Adverbs of place are relatively more common; adverbs of manner are less common. These descriptions contain fewer unmodified nouns. Transformationally, unpleasant descriptions are characterized by fewer internalized adverbial phrases and more cases of clefting and there insertion.

Two aspects of these findings seem especially important to an overall understanding of structural differences occurring within the descriptions of different emotional states. First, 10 of the 15 variables

Table 4

Means and F Scores for Syntactic Variables Significantly Differing within the Evaluation Dimension

Syntactic variables	Pleasant	Unpleasant	F scores
1. #Sent	34	42	5.42^{*}
Composite variables			
2. S_{emb}	.49	.55	10.29^{**}
3. $\overline{ADV}_i$	.47	.61	34.84^{**}
4. $\overline{AUX}$	.16	.19	3.92^{*}
Phrase structure rules			
5. Sen Morp → Neg	.04	.11	33.08^{**}
6. VP → ADV_i+	.09	.14	5.40^{*}
7. Pred → NP	.35	.30	3.82^{*}
8. ADV_i → ADV_p	.09	.12	5.35^{*}
9. ADV_i → ADV_m	.54	.49	3.48^{*}
10. NP → N	.64	.60	7.55^{**}
11. NP → S	.10	.12	6.98^{**}
12. Aux → M	.07	.10	4.21^{*}
Transformations			
13. Adverb internal.	.27	.23	4.78^{*}
14. There insertion	.005	.011	7.38^{**}
15. Clefting	.005	.010	3.78^{*}

$^{*}p < .05$

$^{**}p < .01$

found to be significantly different for descriptions of pleasant and unpleasant emotions are also present among those syntactic variables significantly differing for discrete emotions and account for 10 of the 19 variables in Table 1. By referring back to Table 1 and especially to the notation used to distinguish scores significantly different from the overall mean, it can be seen that many of the differences among discrete emotions can be more meaningfully interpreted as being at least partially due to the location of these emotions on the evaluation dimension.

More specifically, amount of negation is one of the two variables which consistently differentiates both positive and negative emotions from the overall mean. The emotion of sadness is the only exception in that within descriptions of this emotion negation does not differ from the average. Similarly, the frequency of adverbial modification clearly differentiates all emotions except anger. On the other hand, some variables seem to differentiate pairs of emotions. For example, fear and liking are differentiated by the amount of auxiliary modification and adverbs of place. The other criteria differing for both discrete emotions and positive and negative effect (i.e., number of sentences; proportion of embedded sentences; cases of multiple adverbial modification and frequency of noun phrase predicates, unmodified nouns and there insertion) differentiate three or more of these emotions but there is no consistent pattern that can be detected. There are also no reversals, i.e., cases in which the direction above or below the mean for a discrete emotion is inconsistent with the evaluation class to which it belongs. In summary, while there are differences among discrete emotions, there does not seem to be a discernable pattern among these differences and the evaluation dimension seems to be the most parsimonious way of organizing the differences obtained.

In terms of sheer frequency of differences above or below the average, it may be noted that fear and disgust among the unpleasant emotions and liking among the pleasant emotions are most clearly differentiated -- even though the differentiating criteria are not identical in all three cases. Anger and sadness in particular are less clearly differentiated from positive emotions with only 2 and 3 above average variables, respectively.

From this, it seems likely that many of the syntactic differences among discrete emotions are actually due to differences between pleasant and unpleasant emotions, but a second equally significant feature of this data is that with the exception of rules describing the types of predicates and adverbial phrases normally found and the transformational rule specifying the location of adverbial phrases, all of the rules differentiating pleasant and unpleasant emotions seem to be related to and subsumed by a single overriding factor -- grammatical complexity. Each rule serves to increase the complexity of the sentence in which it occurs by introducing extra elements or additional modification. They also show the same pattern of results, i.e., descriptions of unpleasant emotional experiences are more grammatically complex than descriptions of pleasant emotional experiences.

A final point that should be made is that the evaluation dimension by itself is not capable of accounting for all syntactic differences occurring within the descriptions of specific discrete emotions. The particular type of verb phrase expansion, for example, is entirely unrelated to the relative ranking of that emotion along the evaluation dimension. Other variables seem to be somewhat related, but with a good deal of overlap between descriptions of pleasant and unpleasant emotions. For example, the pleasant emotions of happiness and liking have the greatest number of false starts (.11 and .12 respectively), but curiosity, which is also a pleasant emotion, has relatively few false starts (.07) -- less than three of the four unpleasant emotions. This suggests that other dimensions must be tested if the total pattern of results is to be explained on the basis of dimensional differences alone.

DIFFERENCES WITHIN THE INTENTIONALITY DIMENSION

The intentionality dimension, like the evaluation dimension, was derived from having previous subjects rate each of the seven emotions on a set of seven-point bipolar scales. The rating was actually derived from three separate scales, (1) intentional-unintentional, (2) deliberate-impulsive, and (3) controlled-unrestrained, whose correlations and factor loading were sufficiently high to be collapsed into a single factor. A mean-split among emotions on this factor yields two groups: (1) those rated as intentional, liking, curiosity, disgust, and anger and (2) those rated as unintentional, happiness, sadness, and fear. The means and $\underline{F}$ scores for syntactic variables significantly differing for these two groups are shown in Table 5.

Table 5 shows that four of the six significant differences between intentional and unintentional emotions are directly related to the type of verb phrase expansion. Noun phrases and prepositional phrases (i.e., direct and indirect objects) are more common in those emotions rated as intentional, whereas intransitive verbs and predicates are more common for emotions rated as unintentional. Adverbial phrases made up of adjective phrases and moveable particles are also more common for emotions rated as unintentional.

When these six variables are added to those found to differ significantly for pleasant and unpleasant emotions, the resulting list accounts for all but four of the 19 variables differing significantly

Table 5

Means and F Scores for Syntactic Variables Significantly Differing within the Intentionality Dimension

Syntactic variables	Intentional	Unintentional	F score
Phrase structure rules			
1. VP → V_{int}	.03	.06	14.21^{**}
2. VP → Pred	.29	.34	8.78^{**}
3. VP → NP	.35	.26	26.30^{**}
4. VP → PP	.19	.15	7.34^{**}
5. ADV → AP	.40	.46	6.26^{*}
6. V → Vs + Prt_1	.01	.02	5.98^{*}

$^{*}p < .05$

$^{**}p < .01$

among the seven discrete emotions.

Unlike the evaluation dimension, the relatively small number of syntactic variables differentiating both discrete and intentional and unintentional emotions prohibits an attempt to analyze the relative contribution of each emotion to the overall effect. Referring back to items 6 through 9 in Table 1, it can be seen that the best sources of differentiation are the relative frequency of intransitive verbs and direct objects (i.e., VP ⟶ NP), both differentiating five emotions from the overall average. The frequency of intransitive verbs clearly differentiates all intentional and unintentional emotions except liking and interest. Similarly, the frequency of direct objects differentiates all emotions except interest and disgust among the intentional emotions. The two other criteria seem to have more specific differentiating capacity. The frequency of predicates distinguishes the intentional emotion of interest from the two unintentional emotions of happiness and sadness. The number of indirect objects (i.e., VP ⟶ PP) differentiate interest and happiness.

These findings, together with those described in the previous section, suggest that a large part of the variance in the grammatical structure of descriptions of specific emotions can be accounted for by the variance in the evaluation and intentionality dimensions. The evaluation dimension seems to be related to a factor associated with increased modification or grammatical complexity, whereas the intentionality dimension seems to be related to the specific types of verb phrase expansion.

DIFFERENCES WITHIN THE STRENGTH DIMENSION

Because the seven emotions chosen for the present study were selected to represent experiences of moderate intensity, the same procedure used to assess differences within the evaluation and intentionality dimensions could not be used to study differences based on the strength of the emotional experience. Instead, the subjects providing the protocols were asked to rate on a seven-point scale the strength of each experience that they had described.[14] A mean-split was used to separate protocols into descriptions of experiences rated as relatively strong and those rated as relatively weak and a one-way analysis of variance was used to compare differences in the grammatical structure between these two groups. The results of this comparison are given in Table 6.

Though conspicuously absent from the other comparisons made, the most important block of variables related to strength seems to be that related to grammatical errors. Four of the six significant differences are based on speech disturbances or errors in performance. Descriptions of emotional experiences rated as weak contain more total errors, more ungrammatical insertions, and more ungrammatical deletions. The merging of two separate sentences into a single sentence, with the latter retaining and using some of the elements of the former, is more common in descriptions felt to be strong. Strong experiences also contain fewer imperative sentences and less direct objects.

Table 6

Means and F Scores for Syntactic Variables Significantly Differing within the Strength Dimension

Syntactic variables	Strong	Weak	F score
Phrase structure rules			
1. Sen Morp → Imp	.001	.004	3.46*
2. VP → NP	.29	.34	8.07*
Grammatical errors			
3. Ungram. insertion	.17	.21	3.47*
4. Ungram. deletions	.01	.02	5.95*
5. Sentence overlaps	.05	.04	4.81*
6. Total errors	.31	.36	3.02*

*$p < .05$

**$p < .01$

RELIABILITY

The interjudge reliability of the phrase structure and transformational rules used in the present study was calculated by having a second person assign phrase structure and transformational rules to a randomly selected protocol. These assignments of syntactic variables were then compared with those made by the principal investigator and the percentage of agreement tabulated. The protocol used, which was 75 sentences in length, included both a specific and general description (of curiosity). The overall agreement based on dividing the total number of assignments in which the two judges agree by the total number of assignments was extremely high -- 96 percent -- and no constituent or transformation stood out as visibly difficult to mark.

Since the person providing the reliability test received only about four hours of practice prior to making the analysis, it can be assumed that the phrase structure and transformational rules making up Chomsky's model of transformational grammar can be reliably assigned to descriptions with only a minimal amount of prior exposure to these rules.

DISCUSSION

Though it would be simplistic to suggest that the qualitative differences occurring among discrete emotional states can be accounted for by a combination of two or three emotional dimensions,[15] the above data suggest that most of the variations in syntactic structure occurring among specific emotions can be attributed to the location of that emotion on the dimensions tested. Descriptions of weaker experiences, which were also rated as more vague (r = .80), were characterized by a greater number of grammatical errors, particularly ungrammatical insertions and deletions. Descriptions of emotions rated as intentional contained a greater proportion of direct and indirect objects than those rated as unintentional. Differences between the descriptions of pleasant and unpleasant emotions seemed to be due to a single factor -- grammatical complexity. The combination of these three dimensions accounts for 15 of the 19 syntactic variables found to be significantly different for discrete emotions, with the evaluation dimension being the most useful and contributing to 10 of the 19 differences by itself.

The fact that the strength of the emotional experience is related to the frequency of speech disturbances is not surprising. What is surprising to some extent is the direction in which it is related, i.e., increases in grammatical errors are characteristic of weaker emotions. Here it should be stressed that the descriptions of emotions used in the present study were derived by having subjects recall past experiences and the generality of the findings is limited to cases involving recalled experiences. The syntactic structures and relative amount of grammatical errors present in a person's speech during the immediate expression of an ongoing emotional state might be, and probably are, very different from those found for recalled experiences. For example, if a person is experiencing a strong emotion, such as rage or terror, the amount of speech disturbances might well increase, not decrease. The high frequency of grammatical errors in recalled experiences rated as weak seems primarily due to the vagueness of the memories related to these experiences. This relative vagueness might be based on a tendency to "go over" strong emotional experiences after they have occurred to resolve them and attain some kind of closure. Language seems to be frequently used in going over such experiences, so the memories related to them are already in a form amenable to errorless recall and description.

The greater the frequency of direct and indirect objects among emotions rated as intentional is in many ways reminiscent of Brentano's (1874) and later Husserl's (1913) thesis that all intentional acts of consciousness are directed toward an object. While it is clear that subjects providing the intentionality ratings were not using the term "intentionality" in the same sense as Husserl and Brentano, since for these authors all acts of consciousness are intentional and their concept of intentionality does not allow degrees. The ratings of emotions along this dimension, however, do seem to represent a form of object orientation. The emotional experience associated with each of the emotions rated as intentional (i.e. like, dislike, interest, and anger) is always directed toward a specific object -- one likes or dislikes something, is interested in something, or angry about something. The emotions of fear, happiness, and sadness, however, which were rated as unintentional, may or may not be directed toward a specific object depending on the nature of the circumstances involved. Both happiness and sadness, for example, seem to be temporary dispositional states capable of transcending the initial eliciting circumstance. Fear, also, though frequently occurring as a fear of a specific object (e.g., a bear or a final exam), may occasionally exist in a generalized form without a specific referent -- a state commonly referred to as "anxiety". From the location of emotions on the intentionality dimension, it seems probable that the concept of being directed toward an object is inherent in the naive use of the terms "intentional", "deliberate", and "controlled" and that this object orientation shows up in the syntactic structures of descriptions of emotions rated as relatively high along this dimension.

This is not to suggest that intentional object oriented emotions can be differentiated from those actions and feelings that are not intentional by grammatical structure alone. All that is being proposed is that when emotions are grouped into the rather gross categories of intentional and unintentional, the syntactic structures occurring within the descriptions within these categories are quite similar to what might be expected on the basis of their phenomenological structure, i.e., emotions rated as intentional contain more objects than those rated as unintentional. Neither the spread of the ratings of emotions along this dimension, which was limited to a very restricted range, nor the differences actually found within the syntactic variables tested warrant the use of these differences as an indication of intentionality.

The dimension in which syntactic differences seem to be most pronounced and systematic is that of evaluation. Unlike the intentionality and strength dimensions, where the ratings failed to differentiate bipolar ends of the scale and syntactic differences were limited to a small number of variables (six each), the evaluation dimension was clearly separated into two distinct groups and differentiated by a wide range of syntactic variables. This dimension by itself accounted for ten of the 19 syntactic differences found among discrete emotions. One of the most interesting features of these data is that, even though no specific predictions were made and the data themselves include a wide range of different constituents and constituent relationships, the overall pattern of results can be formulated in terms of a single underlying _empirical generalization._ This generalization might be stated as follows:

> _Descriptions of unpleasant emotions contained more modification and tended to be more grammatically complex than descriptions of pleasant emotions_.

This grammatical complexity encompassed almost every aspect of syntactic structure, and descriptions of unpleasant emotions contained more embedded sentences, more adverbial and auxiliary modification, more negation, and fewer unmodified nouns. These descriptions were also characterized by a greater frequency of extrapositioning transformations, clefting and _there_ insertion, in which the deep structure agent is shifted backward in the sentence and a speudo-agent (_there_ or _it_) is introduced in its place.

Since, as argued in the introduction, syntax is not intentionally used to express different emotions or distinguish pleasant from unpleasant emotions, then what is the significance of structural differences occurring within the descriptions of various emotional states? One answer is that these structural differences represent differences in the way positive and negative affects are organized and experienced. This suggestion receives some support by actually going back to the differences occurring between discrete emotions and within the evaluative dimension. The first thing to notice is that the overwhelming majority of differences are based on differences in the use of phrase structure rules, where elements are assigned to the deep structure. Unlike transformations, which simply rearrange elements already present in the deep structure, phrase structure rules represent the underlying semantic content. Except for extrapositioning transformations and those specifying the location of adverbial phrases, transformations are noticeably absent among the syntactic variables differentiating one context from another.

A second point supporting this proposition is that many of the differences among phrase structure rules are not simply "stylistic" variations, but represent differences that directly affect the semantic interpretation and cannot simply be made up by rephrasing the same statement in another form. For example, if a sentence is modified by adding auxiliary forms of various sorts, as was more frequently the case with description of unpleasant emotions, e.g.,

(1) I am angry. (Aux → T)

(2) I will be angry. (Aux → T + M)

(3) I have been angry. (Aux → T + Perf)

(4) I am being angry. (Aux → T + Prog)

(5) I start being angry. (Aux → T + Incho)

it can be seen that the effect of adding such auxiliary modification is a much greater degree of temporal specificity than occurs in the unmodified form.

The addition of adverbial phrases of various sorts also adds a degree of specificity that would be difficult to duplicate by simply rephrasing the statement in a different form. Adverbs of place, for example, tend to restrict the act or statement to a definite location, frequently with the implication that it does not occur beyond these limits. Adverbs of time tend to set temporal restrictions, e.g.,

(6) Bill was severely disturbed when he was a child.

Adverbs of purpose and manner often seem to specify the conditions necessary for an act to occur, e.g.,

(7) If I graduate, I will teach school. (adverb of manner)

(8) I will teach school because I like children. (adverb of purpose)

Each statement not only establishes the conditions necessary for an act to occur but also establish the relationship between the two propositions. Notice how the statements change if the embedded sentence in the adverbial phrase is restated as a simple matrix sentence,

(9) I will graduate(possibly). I will teach school.

(10) I will teach school. I like children.

Negation seems to behave in a similar manner. Except for a few dichotomous choices, e.g.,

John is dead, versus John is not alive.

Jan is single, versus Jan is not married.

it is doubtful whether the negation of a sentence is ever equivalent to a restatement of the same sentence in an affirmative form. This seems especially true when the proposition being negated allows for a variation in degree, as in the following two statements,

Mary is happy. versus, Mary is not sad.

where "not sad" seems to represent not only the state of being happy, but every conceivable degree in between. The meaning changing property of the negative transformation is in fact one of the motivations behind Katz and Postal's (1964) introduction and Chomsky's (1965) endorsement of a sentence morpheme dominating a nonoptional negative morpheme in the deep structure.

Even those extrapositioning transformations, which serve to differentiate positive and negative effect, seem to be more than simple stylistic variations. By shifting the deep structure agent backwards in the sentence and introducing a pseudo-agent (there or it) in its place, these transformations not only increase grammatical complexity, but also serve as a means of de-emphasizing and denying the deep structure agent its status as initiator of the action.

All of these, and related findings, suggest that the increased grammatical complexity characteristic of negative affect is not an end in itself, but that this increase in grammatical complexity is a by-product of a greater need to qualify statements about unpleasant emotions and unpleasant emotional experiences and that this increased qualification based on more complex sentence constructions, additional adverbial and auxiliary modification, modification of nouns, and more frequent use of extrapositioning and denial necessarily leads to more grammatically complex sentences.

Even though people do not communicate emotional states intentionally through syntax, these structures are nonetheless expressive of certain emotional states. The relationship of syntax to emotional expression is similar to that of physiological changes such as flushing. People do not flush in order to communicate embarrassment. They flush when they are embarrassed and this expresses a component of their underlying emotional state.

This leads to the interesting speculation that syntax may be used implicitly by others to make attributions about emotions. In other words, syntax may not only express emotions but may also communicate emotions in the more restricted sense used by Wiener, Devoe, Rubinow, and Geller (1972). While this claim cannot be argued on the basis of the present experiment, it is an empirical question that can be easily tested by manipulating syntactic structure within a given protocol and having people rate the relative pleasantness or unpleasantness of the resulting descriptions. If this suggestion proves valid, then the present study may be interpreted as a comprehensive and systematic attempt to make explicit a process used tacitly in making emotional attributions in everyday interactions.

Before proceeding to a discussion of the possible implications of the above findings for future research and therapy, it seems important to point out some limitations on the type of inferences that can be made on the basis of the above generalization. First of all, it should be restressed that these differences are derived from descriptions of recalled experiences and the use of recalled experiences to describe in a general way how one experiences a given emotion. These are differences in what Merleau-Ponty (1962) and others have called the reflective experience, i.e., the type of experience that one encounters when he views himself within a given situation. Recalled descriptions are obviously of this type since cognitive labelling is involved in reviving such memories. Differences in the syntactic structure or the immediate experience might be and probably are very different. For example, while reflective descriptions of anger are characterized by coherent declarative statements with increased qualification and grammatical complexity, the immediate expression of anger probably produces a pattern that is exactly the reverse, i.e., short unmodified statements with a high frequency of imperatives or commands. Whether this same pattern of results holds for the immediate expression of other emotions is an empirical question that can be tested but which cannot be answered from the above data.

Second, the exclusive use of recalled experiences limited the model to declarative statements and restricted the use of imperatives and interrogatives, which may vary more systematically in a less structured dyadic situation (such as therapy). In the above study only a small percentage of sentences within protocols were questions and commands (.4% and.2% respectively) and these were usually limited to paraphrases of recalled statements. Within a dyadic situation, questions and commands probably occur more frequently and might vary systematically depending on the emotion being discussed.

Finally, the type of descriptions called for also limited variations in verb tense. The specific recalled experiences were written predominantly in the past tense (56%), whereas the general descriptions were written almost exclusively in the present tense (92%). Though tense has previously been found to vary with emotional state (Fairbank, 1944; Seeman, 1949; Zimmerman & Langdon, 1949; Grumman, 1950), in the present experiment little variation was possible because of the nature of the task involved.

The nature of the task not only limited the generality of certain aspects of the present findings, it also served to restrict those syntactic differences which did occur. This is because subjects responded to either a single emotional term ("happiness", "sadness", "anger", or "fear") or, in the case of three emotions, multiple terms ("liking, acceptance of", "disgust, dislike of", "interest, curiosity in") and the variability in the interpretation given to a term or set of terms by individual subjects increased the variability among the type of experiences being described and limited syntactic differences occurring among these descriptions. For example, even though "liking, acceptance of", was usually described as a pleasant emotional experience, one male subject described his acceptance of his ex-girlfriend's new lover.

Here, the term "acceptance of" is used as a form of resignation and predictably the grammatical structure of this description was much closer to that for descriptions of unpleasant emotions than descriptions of pleasant emotions. A second example is where a female subject, a nursing student, used the dissection of a human cadaver to exemplify a time when she felt curious. "Interest, curiosity in", like "liking, acceptance of", was usually described as a pleasant emotion, but here the experience involved getting nauseous and finally vomiting.

The point being suggested is that the syntactic differences present in the descriptions used in the present study might have been even greater if the protocols had been more carefully screened and only noncontested examples of a given emotional state analyzed. Those descriptions of pleasant emotions containing unpleasant associations did tend to have a grammatical structure more similar to that of unpleasant descriptions and this tended to reduce the differences found between descriptions of pleasant and unpleasant emotions.

But in spite of these limitations, differences did occur and differences within the evaluation dimension were especially pronounced. This finding seems to support a proposition implicit in an early study by Davitz (1964). Davitz, working with paralinguistic phenomena, found that vocal features, such as loudness, pitch, length, clipping and blurring, do not express emotions per se, but seem to express something of the overall intensity of the emotional experience. In the present study, intensity was characterized by changes in the amount of grammatical errors, whereas syntactic differences primarily expressed differences within the evaluation dimension. Both studies suggest that information from different expressive channels may not be combined in a simple additive way, each contributing a certain percentage to the total attribution (c.f. Merharbian & Wiener, 1967). Instead, different channels may contribute to different aspects of the final attribution. Information about intensity seems to be carried primarily by paralinguistic features, whereas information about the pleasantness or unpleasantness of the experience is carried, at least in part, by syntactic structures.

Though people do not explicitly use this channel to make emotional attributions, the systematic study and description of syntactic differences across emotional states does open up the potential use of syntactic structure for emotional attributions. The overall consistency and simplicity of the finding that descriptions of past emotional experiences are characterized by increased grammatical complexity greatly enhances its potential use for making emotional attributions. Anyone wishing to make explicit use of this channel (for example, therapists) need not do a complete syntactic analysis. He has only to watch for gross changes in grammatical complexity, particularly changes in negation and adverbial and auxiliary modification. Such changes might be an indication that the person talking has changed from a pleasant or neutral topic to one that has unpleasant associations for him.

But these findings can also be systematically applied to experimental investigations. Since grammatical complexity seems to be an underlying feature characteristic of many of the specific syntactic variables differentiating pleasant and unpleasant descriptions, individual differences within this dimension can be combined into a single measure of grammatical complexity. Such a combination would maximize the effect of each variable and enhance the utility of the overall measure by reducing spurious effects among individual variables which may prevent them from reaching significance. The variables making up the *grammatical complexity scale* should share three characteristics:

(1) Each variable should independently differentiate descriptions of positive and negative effect (or, at the very least, not contradict differences occurring among variables that do differentiate these emotions).

(2) Each variable should be clearly related to grammatical complexity, so that variations within this variable increase or decrease the overall complexity of the sentence in which it occurs.

(3) Each variable selected should not be redundant with or subsumed by other variables used to measure grammatical complexity.

A preliminary attempt to devise such a scale, along with the rationale for selection and deletion of specific items, is included in Appendix C.

The use of this scale, however, should not be attempted without a few words of caution. First of all, a single experiment, while suggestive, is not sufficient by itself to confirm the relationship between grammatical structure and aspects of emotional states such as their global nature on a pleasantness-unpleasantness dimension. Second, negation and grammatical complexity seem to be related not only to the pleasantness or unpleasantness of an emotional experience, but to a number of other factors as well. For example, a follow-up investigation to the current study (Kuiken & Collier, in preparation) suggests that grammatical complexity also increases for counter-attitudinal statements about both liked and disliked characteristics, where an individual is asked to affirm or deny qualities characteristic of his basic values. Individuals also vary greatly in the complexity of their grammatical structures, and complexity based on additional qualification is also characteristic of certain types of discourse. For example, scientific writing is more complex than non-scientific writing (Winter, 1969) and notorious for the number of qualifications. Conversation tends to be less complex than written discourse (Winter, 1969), with telephone conversation being more simple still (Ervin-Tripp, 1969). And reflective descriptions may well differ from the immediate, prereflective expression of the same emotional state. All of these complicating factors do not prohibit the use of syntactic structures for emotional attributions, but they do suggest that changes or differences in grammatical complexity may be a better index than raw frequency of such variables. Such a procedure would automatically contrast these differences to something approximating an individual's own baseline and, if not due to obvious situational factors, the differences might be attributable to underlying emotional states.

It should also be restressed that because descriptions of discrete pleasant emotions tended to be quite similar, as did descriptions of unpleasant emotions, syntactic structure does not appear to be a good index of discrete emotions. It seems to be most useful for making attributions about the global nature of an emotional experience, i.e., attributions regarding the pleasantness or unpleasantness of the felt emotion.

In addition to clinical and experimental application, it might also be possible to use certain forms of syntactic analysis in conjunction with phenomenological procedures in a way that both facilitates the discovery of syntactic differences occurring within the descriptions of different types of experience and increases the probability of identifying essential features characteristic of the phenomenon under investigation. Language has been recognized as an essential feature underlying the reflective experience and there is even some suggestion that the language used in organizing and directly experiencing an event at the reflective level is quite similar to that used to communicate these experiences to others (Merleau-Ponty, 1964). If this proves to be the case, then the exploration of grammatical structures may turn out to be a viable means for getting at the underlying structure associated with a given phenomenon. The implications go far beyond emotional expression or even experiences of a primarily affective nature. The application of a rigorous syntactic analysis can potentially be applied to any phenomenon in which language plays either a direct or indirect part. Structural differences within the description of a given phenomenon might serve as a behavioural measure indicative of the underlying experiential state, and such a procedure might be used in conjunction with or as a supplement to equally rigorous phenomenological procedures (e.g., Colaizzi, 1969; Collier, 1974; Giorgi, in press; and Van Kamm, 1969) in order to reveal essential features characteristic of a wide range of psychological phenomena.

FOOTNOTES

1. For a comprehensive but dated review of the research in this area up to 1964 see Mahl and Schulze (1964). For a more recent review, see Vetter (1969).

2. The most detailed presentation of Chomsky's Aspects model is presented by Chomsky himself (1965). A highly condensed account of Chomsky's basic position is presented by John Lyons (1970). For a critical review, see Derwing (1973). A detailed list and description of the phrase structure and transformational rules used in the present study is presented in the methods section of this paper -- "THE DEPENDENT VARIABLES -- SYNTACTIC DIFFERENCES" (p. 28 ff.)

3. While stylistic differences due to the presence or absence of optional transformations may be "meaningful", for example, producing a change in emphasis (Katz & Postal, 1964), they are not "meaning changing". For this reason, the occurrence of an optional transformation is seen as a change in the "style" of a person's discourse, as opposed to a change in the context or meaning of his statement.

4. While it is usually true that the passive transformation is not meaning changing, there are a limited number of cases where the implicit meaning of a given statement is changed by its application. A good example of this (Prideaux, personal communication) is the application of the passive transformation to the structural description for the following sentence, where the term somebody undergoes a change in meaning.

(1) Somebody kissed all the girls in the room.

(2) All the girls in the room were kissed by somebody.

The most natural interpretation for the first sentence is that the term somebody refers to a single individual, whereas somebody in the second passive sentence seems to refer to anyone (in the room). Because of examples like this, the passive transformation, like those for questions and imperatives, is often treated as an obligatory transformation triggered by the presence of a passive sentence morpheme in the deep structure (Katz & Postal, 1964).

For descriptive purposes, it makes little difference whether one counts the occurrence of a passive sentence morpheme, while ignoring obligatory passive transformations, or one counts optional passive transformations. The important thing is to be able to distinguish and tally the number of passive sentences and either procedure works equally well.

5. It should be noted that if the process position is taken, then one of the things that is lost is the concept of a universal grammar. Not only may individuals fail to learn specific rules or learn alternative rules in their place, but the rules actually learned are dependent on the surface structure of the native language, since this represents the raw materials from which generalizations are formed. For example, English relative clauses can be represented by the expansion of a noun phrase into a noun phrase and a sentence (i.e., NP ⟶ NP + S), but in Japanese the most economical representation of relative clauses is

NP → S + NP, because such clauses always precede the noun phrase they modify. Those adopting the universal grammar position have attempted to account for these differences by claiming that Japanese speakers learn NP → NP + S plus an additional obligatory clause fronting transformation, but this violates the simplicity criteria implicit in the process view.

6. Although the reliability of a full explicit version of transformational grammar should be, after the omission of errors based on counting and misassignment of constituents to categories, theoretically perfect, the current version is in many ways too powerful for perfect reliability, because it is often possible to account for the same surface sentence by more than one choice of rules. For example, any relative clause modifying a single noun can be handled by either having the noun phrase expanded to a noun phrase plus a sentence followed by the expansion of the noun phrase into a noun, i.e.,

(1a) NP → NP + S
(2a) NP → N

or by having a noun phrase expand to a noun plus a complement followed by the expansion of the complement into a sentence, i.e.,

(1b) NP → N + Comp
(2b) Comp → S

The product of both sets of expansions is exactly the same, i.e., N + S, though the choice of phrase structure rules and the resulting tree diagram are entirely different. Numerous other structural descriptions can be accounted for in more than one way.

For this reason, descriptive adequacy is not sufficient to insure perfect agreement among different persons looking at the same data and additional restraints must be placed on the application of specific phrase structure rules to improve the interjudge reliability of the model. Restraints found necessary in the present study include the following:

(A) Sentence complements following nouns are limited to cases where no coreferential noun exists within the embedded sentence (Chomsky, 1970). All embedded sentences with coreferential nouns in the deep structure are treated as relative clauses.

(B) Adverbs occurring directly in front of adjectives, e.g.,

He was really mad.

are treated as cases of modified adjectives (i.e., AP → Adv + A) not as adverbial phrases that have been fronted by an optional adverb movement transformation, which shifts a terminal adverbial phrase to a position within the sentence.

(C) Co-occurring adverbial phrases, e.g.,

He drove fast and recklessly.

are treated as multiple adverbial phrases (i.e., ADV_i+) unless they refer to separate events, e.g.,

We went to dinner and to a movie

In which case, they are treated as conjoined sentences followed by constituent deletion.

(D) Complement structure following adjectives are written as part of the adjective phrase (i.e., AP ⟶ A + Comp) when they serve to modify or indicate the intensity of the adjective, e.g., "mad as hell", and "scared to death" are both written as

(1) AP ⟶ A+Comp
(2) Comp ⟶ PP

In other cases, where the adjective is dominated by a predicate, these structures are treated as major constituents (prepositional phrase or sentence) dominated directly by the verb phrase, e.g.,

(3) He was kind to animals. (VP ⟶ Pred + PP)
(4) She was afraid to go out.(VP ⟶ Pred + S)

(E) Embedded sentences within a verb phrase are dominated by a noun phrase, i.e.,

(1) VP ⟶ NP
(2) NP ⟶ S

whenever the passive transformation can apply to them or they can be replaced by a pronoun, e.g.,

I know that he is honest

can be rewritten as,

That he is honest is known by me

and it is also grammatical to say,

He is honest and I know it,

where it is a pronoun replacing the entire embedded sentence.

When the passive cannot apply or a pronoun cannot be substituted, the verb phrase is expanded directly into a sentence, i.e.,

(3) VP ——→ S

without an intervening noun phrase, as in the sentence,

I guess that he is honest,

where both,

*That he is honest is guessed by me.

*He is honest and I guess it,

are ungrammatical.

Once these specific restrictions were incorporated into the present model, the interjudge reliability was tested by having a second judge describe a randomly selected protocol. Percent agreement between judges was then calculated by comparing descriptions.

7. These descriptions of grammatical errors are not included in Chomsky's model, because Chomsky is concerned only with linguistic competence (i.e., what a native speaker "knows" about his language), not with performance (i.e., the actual use of language in concrete situations). Though Chomsky (1965) recognizes the presence of speech disturbances in normal conversation, he does not consider the description of such disturbances the domain of generative grammar (i.e., transformational grammar) and states explicitly that

> Generative grammar is not a model for a speaker or a hearer. It attempts to characterize in the most neutral possible terms the knowledge of the language that provides the basis for the actual use of a language by a speaker-hearer (p.9)

In addition to being outside the province of transformational grammar, performance transformations of the type used in the present study differ from post-*Aspects* transformations in two ways. First, while post-*Aspects* transformations are concerned exclusively with grammatical sentences, performance transformations are postulated for the explicit purpose of describing and classifying specific types of ungrammaticalness. Secondly, while unrecoverable deletions are not permitted in post-*Aspects* transformations, i.e., no element of a structural description may be deleted without a substitution of a new element that marks its presence in the deep structure, unrecoverable deletions do occur in performance transformations and, in fact, unrecoverable deletions are precisely what is being accounted for in three of four of these transformations.

8. For a more detailed review of this literature and the distinction between discrete emotions and the dimensional approach, see either Plutchik (1962) or Ekman, Friesen and Ellsworth (1972).

9. When a protocol contains only a single sentence, the presence of any given phrase structure is highly significant with a probability at or near 1.00.

10. See Chomsky (1965) for a discussion of the acceptable-grammatical distinction.

11. Though there are no specific restrictions on types of adverbial phrases and the expansion of adverbial phrases into adjective phrases, noun phrases or prepositional phrases, there is a tendency for adverbs

of specific types to be expanded in specific ways. For example, in the sample of sentences derived from the present study, adverbs of time and purpose tended to be noun phrases (r = .51 and r = .25, respectively); adverbs of place are more commonly prepositional phrases (r = .36); and adverbs of manner are usually adjective phrases (r = .44). All of these correlations are significant at above the .01 level.

12. Though the below example is flexible enough to take any one of the three complement forms, other complements are more restricted in the forms which they can take. For example, the verb _want_ can occur with a (_for_)_to_ complement, as in,

I want _for_ you _to_ go.

or I want _to_ go.

but it cannot grammatically occur with _that_, as in,

*I want _that_ you go.

The verb _think_, on the other hand, can occur with _that_, e.g.,

I think _that_ Nixon was President at the time.

but not with (_for_)_to_,

*I think _for_ Nixon _to_ be President at the time.

Many other verbs and structural descriptions are similarly restricted.

13. The evaluation dimension is well suited for this type of analysis, because the means for emotions along this dimension fall into two clearly defined groups, with the means for the pleasant emotions of happiness, liking and curiosity (1.26, 1.84, 2.68, respectively) being

clearly distinguishable from the means of the unpleasant emotions of anger, fear, sadness and disgust (5.34, 5.43, 5.65, and 5.71 respectively). Although the two ends of this dimension are clearly distinguishable, there is little reason to assume a linear change in the relative frequency of syntactic structures, since the mean scores among pleasant emotions along this dimension are quite similar and those for unpleasant emotions are almost indistinguishable.

14. The rating given a specific experience along the dimension of strength was not significantly related to and appears to be almost completely independent of the ratings given to that emotion on the evaluation and intentionality dimensions. The Pearson's product movement correlation between the strength and evaluation dimension was .00. The correlation between strength and intentionality was -.08.

15. Sadness and fear, for example, were both rated as unpleasant and unintentional and showed similar variations in rated strength, yet they are clearly distinguishable experientially and subjects showed no signs of confusing the two.

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APPENDIX A

SUMMARY OF PREVIOUS STUDY USED TO ESTABLISH DIMENSIONS USED IN THE PRESENT INVESTIGATION

Because of the lack of consistency among dimensional theorists, a separate study was used to derive the emotional dimensions most appropriate for the seven emotions used in the present investigation.

METHOD

Twelve emotional dimensions either found or postulated by previous theorists were transformed into seven-point bipolar scales and 100 Introductory Psychology students were asked to rate the seven emotions (happiness, sadness, fear, anger, liking, dislike, and curiosity) along these twelve dimensions. The actual scales used and the source for these scales are as follows:

(1) Pleasant-unpleasant -- Schlosberg (1952), Osgood (1966), Frijda (1968) and most others.

(2) Active-passive -- Plutchik (1962) and Osgood (1966)

(3) Controlled-unrestrained -- Osgood (1966) and Frijda (1968)

(4) Public-private -- related to introversion-extraversion (Kassenbaum, Couch & Slater, 1959; Schaefer,(1961)

(5) Expressive-constrained -- also related to introversion-extraversion and aggressive-social apprehensive (Richards & Simons, 1941)

(6) Good-bad -- Plutchik (1962)

(7) Intense-relaxed -- Wundt (1896) and Schlosberg (1954)

(8) Approach-withdraw -- Duffy (1941)

(9) Strong-weak -- Plutchik (1962) and Frijda (1968)

(10) Expansive-contractive -- Reich (1949)

(11) Intentional-unintentional -- related to self-assertive -- dependence (Frijda, 1970)

(12) Deliberate-impulsive -- related to ego-strength -- ego weakness (Kassenbaum, Couch.& Slater, 1959)

The terms "public-private", "expressive-constrained", "intentional-unintentional", "deliberate-impulsive", were substituted for the dimensions of introversion-extraversion, aggressive-social apprehensive, self-assertive-dependence, and ego-strength -- ego-weakness to permit adjectives more easily identified by Introductory Psychology students.

RESULTS

A separate factor analysis (with principle component analysis and varimax rotation) was done on each of the seven different emotions. This resulted in three factors in which individual scales consistently grouped together in a majority (i.e., four) of the seven emotions tested:

I. Evaluation -- consisting of the dimensions of pleasantness unpleasantness and good-bad.

II. Intentionality -- consisting of the dimensions of intentional-unintentional, deliberate-impulsive and controlled-unrestrained.

III. Expressiveness -- consisting of expressive-constrained, approach-withdraw and expansive-contractive.

When the mean score for each of the three separate factors was calculated by summing the scores on the individual dimensions making up that factor, the two factors of evaluation and expressiveness were found to be highly correlated (r = .91), so the expressive factor was dropped. The intentionality and evaluation factors were only moderately correlated (r = .41). The rank and mean scores obtained by the seven individual emotions on the evaluation and intentionality dimensions are shown in Tables 7 and 8, respectively.

While the intentionality dimension shows a somewhat gradual increase across the seven different emotions, the evaluation dimension shows a clear split into two group,s (1) pleasant emotions consisting of happiness, liking and interest, (2) unpleasant emotions consisting of anger, fear, sadness and disgust. The means for pleasant emotions along this dimension are quite similar, while the means for unpleasant emotions are almost indistinguishable.

Plutchik's and Osgood's active-passive dimension was found to be related to two separate factors, intensity and expressiveness. Public-private and strong-weak were both related to almost everything else, making them poor discriminators. Intensity showed up as an independent factor but with a very limited range. This was due to the fact that only moderately intense emotions were rated. If panic and apprehension had been included along with fear or annoyance and rage along with anger, intensity may very well have emerged as a strong independent factor. But the choice to use only moderately intense emotional terms was made for two reasons. First, extremely intense emotions occur very infrequently in everyday life. While a subject was able to recall experiences of fear and anger, he may have to search a great deal in his past in order to find instances of terror and rage and a number of subjects may never have

Table 7

Mean Scores for Emotions Ranked Along the Evaluation Dimension

Rank	Emotion	Mean
1	Happiness	1.26
2	Liking	1.84
3	Interest	2.68
4	Anger	5.34
5	Fear	5.43
6	Sadness	5.65
7	Disgust	5.71

Note. A score of 1 means very pleasant and a score of 7 means very unpleasant. Overall mean = 3.99.

Table 8

Mean Scores for Emotions Ranked Along
the Intentionality Dimension

Rank	Emotion	Mean
1	Liking	3.76
2	Interest	4.27
3	Disgust	4.29
4	Anger	4.44
5	Happiness	4.76
6	Sadness	4.83
7	Fear	5.21

Note. A score of 1 means very intentional and a score of 7 means very unintentional. Overall mean = 4.51.

experienced these emotions. Second, as Plutchik (1962) has pointed out, emotions tend to merge at the lower end of the intensity continuum and it is more difficult to discriminate between instances of annoyance and apprehension than it is to discriminate between anger and fear or terror and rage.

Because intensity or strength seems to represent an important dimension, frequently found by previous investigators (e.g., Wundt, 1896; Schlosberg, 1954; Plutchik, 1962; Frijda, 1968), a separate procedure was used to assess the effects of strength on syntactic structures. The subjects providing the emotional descriptions for the present study were asked to rate the strength of each emotional experience on a seven-point scale and the resulting scores were then divided into two groups, those rated as relatively strong and those rated as relatively weak.

APPENDIX B

TABLES OF COMPLETE DATA

Table 9-B1

Means and F Scores for Emotions on all Syntactic Variables Tested

Syntactic variables	Means for emotions							F score
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
1. #Sent	39	32	31	39	44	44	42	2.76^{*}
Composite variables								
2. S_{emb}	.48	.48	.51	.54	.54	.54	.58	2.61^{*}
3. $\overline{ADV}_i$	.48	.48	.47	.56	.61	.63	.64	7.33^{**}
4. $\overline{AUX}$	.16	.14	.18	.19	.22	.16	.17	2.47^{*}
Phrase structure rules								
5. Int	.09	.08	.08	.07	.06	.08	.09	1.18
6. Conj	.03	.04	.03	.04	.02	.03	.02	1.76
7. Conj Adv	.03	.03	.03	.02	.03	.02	.03	--
8. Sen Morp $\rightarrow$ Q	.001	.003	.007	.004	.005	.004	.007	--
9. Sen Morp $\rightarrow$ Imp	.000	.004	0	.003	.007	.002	.000	1.66
10. Sen Morp $\rightarrow$ Neg	.04	.07	.06	.11	.10	.09	.12	5.28^{**}
11. VP $\rightarrow$ V_{int}	.05	.03	.04	.03	.05	.07	.02	4.06^{**}

Table 9-B1 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
12. VP → Pred	.36	.29	.27	.30	.28	.37	.28	2.77^{*}
13. VP → NP	.27	.39	.30	.36	.28	.23	.34	6.70^{**}
14. VP → PP	.12	.15	.24	.16	.16	.16	.19	4.03^{**}
15. VP → S	.21	.17	.21	.21	.22	.19	.22	1.45
16. VP → ADV$_i$	.27	.27	.29	.24	.30	.28	.28	1.04
17. VP → ADV$_i$+	.09	.09	.08	.13	.12	.15	.16	6.70^{**}
18. Pred → AP	.55	.45	.63	.66	.53	.62	.57	3.29^{*}
19. Pred → NP	.34	.43	.27	.25	.32	.28	.30	6.22^{**}
20. Pred → PP	.10	.12	.10	.09	.15	.10	.13	--
21. ADV$_i$ → ADV$_t$	.31	.33	.26	.32	.29	.36	.32	--
22. ADV$_i$ → ADV$_p$	.10	.07	.09	.12	.15	.09	.11	2.80^{*}
23. ADV$_i$ → ADV$_m$	.50	.57	.54	.47	.50	.48	.49	--
24. ADV$_i$ → ADV$_{pur}$	.09	.05	.10	.08	.06	.07	.08	--
25. ADV → AP	.48	.38	.42	.40	.46	.45	.42	1.43
26. ADV → NP	.28	.32	.31	.32	.27	.30	.34	--

Table 9-B1 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
27. ADV → PP	.23	.31	.27	.27	.27	.25	.23	--
28. NP → N	.62	.66	.62	.62	.59	.61	.59	3.88**
29. NP → D + N	.20	.17	.20	.19	.22	.19	.21	1.90
30. NP → AP + N	.08	.09	.08	.08	.07	.08	.07	--
31. NP → N + Comp	.04	.04	.06	.05	.05	.05	.05	--
32. NP → S	.10	.10	.09	.12	.10	.12	.12	2.08
33. NP → NP + S	.03	.03	.04	.03	.04	.04	.04	--
34. D → Art	.65	.68	.58	.64	.64	.64	.72	1.37
35. D → Dem	.18	.19	.24	.17	.17	.16	.17	--
36. D → Gen	.16	.13	.18	.19	.19	.20	.11	1.08
37. D → Pre-det + ...	.08	.03	.07	.06	.07	.03	.07	1.53
38. AP → A	.83	.83	.85	.78	.85	.83	.85	1.18
39. AP → A + Comp	.01	.03	.02	.01	.01	.02	.04	1.23
40. AP → Adv + A	.16	.14	.15	.21	.14	.15	.11	2.28*

Table 9-B1 (continued):

	Means for emotions							
Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	F scores
41. Aux → M	.08	.08	.07	.09	.11	.07	.11	1.28
42. Aux → Perf	.03	.02	.03	.04	.04	.03	.01	1.48
43. Aux → Prog	.06	.04	.08	.06	.08	.05	.05	2.28*
44. Aux → Incho	.02	.01	.02	.01	.01	.01	.01	1.07
45. V → Vs + Prt_1	.008	.017	.020	.021	.010	.014	.017	1.07
46. V → Vs + Prt_2	.03	.03	.05	.03	.06	.04	.06	2.47*
47. T → Past	.29	.29	.28	.37	.33	.36	.30	1.23
Transformations								
48. Passive	.01	.01	.01	.01	.02	.01	.02	--
49. Conjunction	.19	.20	.19	.22	.21	.20	.22	--
50. Const. deletion	.64	.64	.59	.61	.55	.53	.57	1.04
51. Adverb frontiong	.15	.21	.20	.24	.20	.21	.21	1.05
52. Adverb internal.	.27	.25	.29	.21	.24	.25	.21	1.40
53. There insertion	.003	.007	.005	.007	.013	.009	.016	2.25*
54. Clefting	.005	.006	.005	.005	.010	.007	.016	1.69

Table 9-B1 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
Grammatical errors								
55. Ungram. insertion	.21	.21	.17	.19	.17	.17	.17	--
56. Ungram. deletion	.01	.02	.02	.02	.03	.01	.02	--
57. False starts	.11	.12	.07	.06	.08	.09	.09	2.21^*
58. Sent. overlaps	.05	.04	.06	.05	.04	.05	.03	--
59. Total errors	.38	.38	.32	.32	.32	.32	.31	1.07

Note. Emotions ranked on evaluation dimension.

$^*p < .05$

$^{**}p < .01$

-- F score $<$ 1.00

Table 10-B2

Means and F Scores for Modes of Discourse on all Syntactic Variables Tested

	Modes of Discourse		
Syntactic variables	Specific	General	F scores
1. #Sent	49	29	34.14**
Composite variables			
2. S_{emb}	.50	.55	3.68*
3. $\overline{ADV}_i$	.58	.53	7.76*
4. $\overline{AUX}$	.19	.16	8.56**
Phrase structure rules			
5. Int	.07	.08	--
6. Conj	.04	.02	10.77**
7. Conj Adv	.03	.03	--
8. Sen Morp → Q	.005	.004	--
9. Sen Morp → Imp	.003	.002	--
10. Sen Morp → Neg	.08	.09	--
11. VP → V_{int}	.05	.04	4.50*
12. VP → Pred	.29	.34	12.15**
13. VP → NP	.34	.29	7.78**
14. VP → PP	.17	.17	--
15. VP → S	.18	.22	4.83*
16. VP → ADV_i	.29	.26	2.18
17. VP → ADV_i+	.12	.11	1.65
18. Pred → AP	.52	.63	3.02
19. Pred → NP	.35	.28	1.40

Table 10-B2(continued):

Syntactic variables	Modes of Discourse Specific	 General	F score
20. Pred → PP	.13	.09	1.73
21. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_t$	.31	.32	--
22. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_p$	.15	.05	46.55^{**}
23. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_m$	.44	.57	20.83^{**}
24. $\mathrm{ADV}_i \rightarrow \mathrm{ADV}_{pur}$	.09	.06	5.23^{*}
25. ADV → AP	.40	.46	5.76^{*}
26. ADV → NP	.28	.33	3.96^{*}
27. ADV → PP	.31	.21	15.57^{**}
28. NP → N	.58	.65	42.16^{**}
29. NP → D + N	.24	.16	39.21^{**}
30. NP → AP + N	.10	.06	17.71^{**}
31. NP → N + Comp	.05	.05	--
32. NP → S	.10	.12	11.50^{**}
33. NP → NP + S	.04	.03	--
34. D → Art	.67	.64	--
35. D → Dem	.16	.20	1.94
36. D → Gen	.18	.16	--
37. D → Pre-det + ...	.05	.07	--
38. AP → A	.81	.85	5.06^{*}
39. AP → A + Comp	.02	.02	--
40. AP → Adv + A	.18	.12	12.93^{**}
41. Aux → M	.08	.09	--
42. Aux → Perf	.04	.02	9.80^{**}
43. Aux → Prog	.07	.05	8.38^{**}

Table 10-B2(continued):

Syntactic variables	Modes of discourse		F scores
	Specific	General	
44. Aux → Incho	.01	.01	--
45. V → Vs + Prt_1	.02	.01	--
46. V → Vs + Prt_2	.05	.04	1.47
47. T → Past	.56	.08	137.64**
Transformations			
48. Passive	.01	.01	--
49. Conjunction	.22	.18	6.86**
50. Const. deletion	.54	.64	8.42**
51. Adverb fronting	.15	.25	20.81**
52. Adverb internal.	.22	.27	5.51*
53. There insertion	.009	.008	--
54. Clefting	.009	.006	1.72
Grammatical errors			
55. Ungram. insertion	.19	.18	--
56. Ungram. deletion	.02	.02	--
57. False starts	.08	.09	--
58. Sentence overlaps	.04	.05	1.59
59. Total errors	.34	.33	--

*$p < .05$

**$p < .01$

--F score ≤ 1.00

Table 11-B3

Means and F Scores for Emotion times Mode Interaction on all Syntactic Variables Tested

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
1. #Sent								
Specific	48	44	38	49	55	50	56	--
General	30	21	23	30	33	38	29	
Composite variables								
2. S_{emb}								
Specific	.47	.45	.47	.54	.52	.50	.55	--
General	.50	.51	.54	.54	.56	.57	.61	
3. $\overline{ADV}_1$								
Specific	.52	.52	.51	.58	.62	.68	.62	--
General	.43	.44	.43	.54	.59	.59	.67	
4. $\overline{AUX}$								
Specific	.17	.14	.18	.25	.22	.20	.19	1.65
General	.15	.14	.18	.14	.23	.12	.15	
Phrase structure rules								
5. Int								
Specific	.09	.08	.08	.06	.04	.07	.09	--
General	.10	.08	.07	.08	.07	.08	.08	
6. Conj.								
Specific	.03	.04	.04	.05	.02	.04	.04	--
General	.03	.03	.02	.04	.01	.02	.01	

Table 11-B3 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
7. Conj Adv								1.49
Specific	.03	.02	.03	.02	.03	.03	.05	
General	.03	.03	.03	.03	.04	.02	.01	
8. Sen Morp → Q								--
Specific	.001	.002	.007	.008	.005	.005	.007	
General	.002	.004	.007	0	.004	.003	.007	
9. Sen Morp → Imp								--
Specific	.001	.008	0	.003	.005	.003	.001	
General	0	0	0	.003	.009	.001	0	
10. Sen Morp → Neg								1.84
Specific	.04	.07	.08	.11	.08	.08	.11	
General	.05	.06	.04	.11	.12	.11	.13	
11. VP → V_{int}								1.54
Specific	.07	.04	.03	.04	.08	.08	.03	
General	.04	.03	.05	.03	.03	.06	.01	
12. VP → Pred								1.28
Specific	.31	.25	.27	.25	.27	.32	.28	
General	.40	.33	.27	.36	.30	.42	.29	
13. VP → NP								--
Specific	.31	.38	.33	.42	.30	.27	.35	
General	.23	.40	.28	.31	.27	.19	.32	

Table 11-B3 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
14. VP → PP								3.41^{**}
Specific	.11	.18	.24	.19	.11	.17	.16	
General	.14	.12	.24	.14	.21	.14	.22	
15. VP → S								1.08
Specific	.21	.18	.18	.18	.21	.16	.20	
General	.22	.16	.24	.24	.23	.21	.24	
16. VP → ADV_1								--
Specific[1]	.27	.26	.30	.26	.32	.30	.29	
General	.27	.27	.27	.22	.27	.26	.27	
17. VP → ADV_1+								1.45
Specific[1]	.11	.11	.09	.13	.12	.16	.14	
General	.08	.07	.06	.13	.13	.14	.18	
18. Pred → AP								--
Specific	.50	.44	.58	.58	.50	.53	.52	
General	.60	.47	.69	.73	.56	.71	.62	
19. Pred → NP								1.02
Specific	.39	.44	.26	.31	.33	.37	.32	
General	.29	.42	.27	.19	.32	.18	.28	
20. Pred → PP								1.01
Specific	.10	.12	.16	.11	.17	.10	.15	
General	.11	.11	.04	.08	.12	.10	.10	

Table 11-B3 (continued):

Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	$\underline{F}$ scores
	Means for emotions							
21. $ADV_i \rightarrow ADV_t$								
Specific	.35	.29	.25	.30	.29	.39	.30	--
General	.26	.36	.28	.35	.29	.35	.33	
22. $ADV_i \rightarrow ADV_p$								
Specific	.13	.11	.13	.17	.22	.13	.18	1.01
General	.07	.02	.06	.07	.07	.04	.04	
23. $ADV_i \rightarrow ADV_m$								
Specific	.40	.56	.50	.42	.42	.40	.43	1.06
General	.61	.57	.59	.53	.59	.56	.55	
24. $ADV_i \rightarrow ADV_{pur}$								
Specific	.12	.06	.13	.11	.07	.09	.08	--
General	.06	.05	.08	.05	.06	.05	.07	
25. $ADV \rightarrow AP$								
Specific	.46	.41	.46	.34	.39	.36	.39	2.37^*
General	.50	.36	.38	.46	.53	.53	.44	
26. $ADV \rightarrow NP$								
Specific	.27	.25	.26	.32	.26	.30	.31	--
General	.29	.39	.36	.32	.27	.31	.37	
27. $ADV \rightarrow PP$								
Specific	.26	.35	.27	.33	.35	.34	.29	--
General	.20	.26	.26	.22	.20	.17	.18	

Table 11-B3 (continued):

Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	F scores
	Means for emotions							
28. NP → N								
Specific	.57	.64	.60	.57	.56	.56	.58	
General	.68	.68	.65	.67	.62	.66	.61	1.21
29. NP → D + N								
Specific	.24	.20	.23	.24	.25	.25	.24	
General	.15	.15	.17	.15	.19	.13	.19	1.22
30. NP → AP + N								
Specific	.10	.09	.09	.09	.09	.10	.10	
Genreal	.06	.08	.08	.06	.04	.05	.04	1.57
31. NP → N + Comp								
Specific	.05	.05	.05	.05	.05	.05	.05	
General	.04	.03	.07	.04	.06	.04	.05	--
32. NP → S								
Specific	.09	.07	.08	.12	.10	.11	.10	
General	.11	.13	.10	.12	.11	.14	.14	1.19
33. NP → NP + S								
Specific	.03	.04	.05	.03	.04	.04	.04	
General	.03	.03	.03	.03	.03	.04	.04	--
34. D → Art								
Specific	.68	.59	.67	.65	.73	.55	.73	
General	.62	.77	.48	.63	.55	.72	.71	5.43**

Table 11-B3 (continued):

	Means for emotions							
Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	_F_ scores
35. D → Dem								
Specific	.15	.21	.16	.14	.13	.22	.16	2.12
General	.22	.18	.33	.20	.22	.11	.18	
36.D → Gen								
Specific	.17	.20	.17	.21	.15	.23	.11	2.34*
General	.16	.06	.18	.18	.23	.16	.11	
37. D → Pre-det + ...								
Specific	.05	.03	.08	.06	.05	.04	.05	1.06
General	.10	.03	.06	.06	.10	.02	.10	
38. AP → A								
Specific	.78	.80	.79	.78	.83	.81	.87	2.16
General	.87	.86	.91	.79	.86	.85	.83	
39. AP → A + Comp								
Specific	.02	.02	.02	.02	.01	.01	.02	1.98
General	.01	.04	.01	.01	.01	.02	.07	
40. AP → Adv + A								
Specific	.20	.18	.22	.20	.16	.18	.11	2.20
General	.12	.09	.08	.21	.13	.12	.10	
41. Aux → M								
Specific	.08	.06	.07	.09	.09	.09	.10	--
General	.07	.09	.07	.09	.12	.06	.11	

Table 11-B3 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
42. Aux → Perf								
Specific	.03	.02	.05	.06	.05	.04	.02	--
General	.02	.03	.01	.02	.03	.02	.00	
43. Aux → Prog								
Specific	.06	.06	.06	.10	.08	.07	.06	3.16*
General	.06	.03	.10	.03	.08	.03	.03	
44. Aux → Incho								
Specific	.02	.01	.02	.01	.01	.01	.01	--
General	.02	.00	.02	.01	.01	.00	.01	
45. V → Vs + Prt_1								
Specific	.01	.02	.01	.02	.02	.02	.02	--
General	.01	.01	.03	.02	.00	.01	.02	
46. V → Vs + Prt_2								
Specific	.04	.03	.07	.03	.06	.03	.06	--
General	.03	.03	.04	.03	.05	.04	.06	
47. T → Past								
Specific	.54	.52	.50	.66	.57	.61	.49	--
General	.03	.06	.05	.08	.09	.10	.11	

Table 11-B3 (continued):

Syntactic variables	Means for emotions							F scores
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	
Transformations								
48. Passive								1.39
Specific	.005	.005	.008	.011	.023	.010	.026	
General	.023	.014	.016	.017	.014	.005	.004	
49. Conjunction								--
Specific	.19	.23	.21	.24	.23	.23	.22	
General	.19	.17	.16	.19	.19	.17	.21	
50. Const. deletion								--
Specific	.64	.59	.59	.52	.51	.48	.46	
General	.65	/69	.61	.70	.59	.58	.67	
51. Adverb fronting								--
Specific	.11	.16	.14	.18	.18	.16	.16	
General	.18	.26	.25	.30	.21	.25	.26	
52. Adverb internal.								--
Specific	.26	.25	.27	.18	.21	.19	.21	
General	.28	.26	.31	.24	.27	.32	.21	
53. There insertion								--
Specific	.005	.006	.010	.010	.009	.010	.015	
General	.001	.007	0	.004	.017	.008	.018	
54. Clefting								--
Specific	.005	.006	.010	.007	.010	.007	.022	
General	.005	.005	0	.004	.011	.007	.012	

Table 11-B3 (continued):

Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	F scores
	Means for emotions							
Grammatical errors								
55. Ungram. insertion								
Specific	.22	.23	.19	.19	.17	.19	.17	--
General	.20	.19	.16	.19	.18	.16	.17	
56. Ungram. deletion								
Specific	.01	.03	.01	.02	.03	.01	.01	--
General	.01	.02	.02	.03	.02	.01	.02	
57. False starts								
Specific	.12	.12	.06	.05	.07	.09	.09	--
General	.11	.11	.09	.06	.08	.08	.09	
58. Sent. overlap								
Specific	.03	.05	.06	.04	.05	.05	.02	1.26
General	.07	.03	.05	.06	.04	.04	.04	
59. Total errors								
Specific	.37	.41	.32	.30	.31	.34	.29	--
General	.38	.34	.32	.34	.33	.29	.32	

Note. Emotions ranked on evaluation dimension.

$^{*}p < .05$

$^{**}p < .01$

--F score ≤ 1.00

Table 12-B4

Means and F Scores for Evaluation Dimension on all Syntactic Variables Tested

Syntactic variables	Pleasant	Unpleasant	F scores
1. #Sent	34	42	5.42^{*}
Composite variables			
2. S_{emb}	.49	.55	10.29^{**}
3. $\overline{ADV}_i$	.47	.61	34.84^{**}
4. $\overline{AUX}$	.16	.19	3.92^{*}
Phrase structure rules			
5. Int	.08	.07	1.35
6. Conj	.03	.03	--
7. Conj Adv	.03	.03	--
8. Sen Morp → Q	.004	.005	--
9. Sen Morp → Imp	.001	.003	1.16
10. Sen Morp → Neg	.04	.11	33.08^{**}
11. VP → V_{int}	.04	.05	--
12. VP → Pred	.31	.31	--
13. VP → NP	.32	.30	--
14. VP → PP	.17	.17	--
15. VP → S	.20	.21	--
16. VP → ADV_i	.28	.27	--
17. VP → ADV_i+	.09	.14	5.40^{*}
18. Pred → AP	.55	.59	2.10
19. Pred → NP	.35	.30	3.82^{*}
20. Pred → PP	.11	.12	--

Table 12-B4 (continued):

Syntactic variables	Pleasant	Unpleasant	F score
21. $ADV_i \rightarrow ADV_t$	.30	.32	--
22. $ADV_i \rightarrow ADV_p$	.09	.12	5.35*
23. $ADV_i \rightarrow ADV_m$	.54	.49	3.48*
24. $ADV_i \rightarrow ADV_{pur}$	.07	.08	1.09
25. ADV → AP	.43	.43	--
26. ADV → NP	.30	.31	--
27. ADV → PP	.27	.26	--
28. NP → N	.64	.60	7.55*
29. NP → D + N	.19	.20	1.40
30. NP → AP + N	.08	.07	2.77
31. NP → N + Comp	.05	.05	--
32. NP → S	.10	.12	6.98*
33. NP → NP + S	.04	.03	--
34. D → Art	.63	.66	--
35. D → Dem	.21	.17	2.35
36. D → Gen	.16	.17	--
37. D → Pre-det + ...	.06	.06	--
38. AP → A	.84	.83	--
39. AP → A + Comp	.02	.02	--
40. AP → Adv + A	.15	.15	--
41. Aux → M	.07	.10	4.21*
42. Aux → Perf	.03	.03	--
43. Aux → Prog	.06	.06	--
44. Aux → Incho	.02	.01	2.93
45. $V \rightarrow Vs + Prt_1$	.02	.02	--

Table 12-B4 (continued):

Syntactic variables	Pleasant	Unpleasant	_F_ score
46. V → Vs + Prt_2	.04	.05	--
47. T → Past	.28	.34	2.02
Transformations			
48. Passive	.012	.014	--
49. Conjunction	.19	.21	2.38
50. Const. deletion	.61	.56	2.06
51. Adverb fronting	.18	.21	1.86
52. Adverb internal.	.27	.23	4.78*
53. _There_ insertion	.005	.011	7.38*
54. Clefting	.005	.010	3.78*
Grammatical errors			
55. Ungram. insertion	.19	.17	--
56. Ungram. deletion	.02	.02	--
57. False starts	.10	.08	--
58. Sentence overlaps	.04	.05	--
59. Total errors	.36	.32	1.79

*$p < .05$

**$p < .01$

--_F_ score $\leq$ 1.00

Table 13-B5

Means and F Scores for Intentionality Dimension on all

Syntactic Variables Tested

Syntactic variables	Intentional	Unintentional	F scores
1. #Sent	36	42	3.62
Composite variables			
2. S_{emb}	.53	.52	--
3. $\overline{ADV}_i$	.54	.57	1.90
4. $\overline{AUX}$	.17	.18	--
Phrase structure rules			
5. Int	.08	.08	--
6. Conj	.03	.03	1.55
7. Conj Adv	.03	.03	--
8. Sen Morp → Q	.005	.003	1.34
9. Sen Morp → Imp	.002	.003	--
10. Sen Morp → Neg	.09	.08	1.33
11. VP → V_{int}	.03	.06	14.21^{**}
12. VP → Pred	.29	.34	8.78^{**}
13. VP → NP	.35	.26	26.30^{**}
14. VP → PP	.19	.15	7.34^{**}
15. VP → S	.20	.21	--
16. VP → ADV_i	.27	.28	1.28
17. VP → ADV_i+	.11	.12	--
18. Pred → AP	.58	.57	--
19. Pred → NP	.31	.31	--
20. Pred → PP	.11	.12	--

Table 13-B5 (continued):

Syntactic variables	Intentional	Unintentional	*F* scores
21. $ADV_i \rightarrow ADV_t$	.31	.32	--
22. $ADV_i \rightarrow ADV_p$	.10	.11	--
23. $ADV_i \rightarrow ADV_m$	.52	.49	--
24. $ADV_i \rightarrow ADV_{pur}$	.08	.07	--
25. ADV → AP	.40	.46	6.26^*
26. ADV → NP	.32	.28	2.92
27. ADV → PP	.27	.25	--
28. NP → N	.62	.61	1.45
29. NP → D + N	.19	.21	--
30. NP → AP + N	.07	.07	--
31. NP → N + Comp	.05	.05	--
32. NP → S	.11	.11	--
33. NP → NP + S	.04	.03	--
34. D → Art	.65	.64	--
35. D → Dem	.19	.17	--
36. D → Gen	.15	.18	1.38
37. D → Pre-det + ...	.06	.06	--
38. AP → A	.83	.83	--
39. AP → A + Comp	.03	.01	2.49
40. AP → Adv + A	.15	.15	--
41. Aux → M	.09	.09	--
42. Aux → Perf	.03	.03	--
43. Aux → Prog	.06	.06	--
44. Aux → Incho	.01	.01	--
45. $V \rightarrow Vs + Prt_1$	.01	.02	5.98^*

Table 13-B5 (continued):

Syntactic variables	Intentional	Unintentional	F scores
46. $V \rightarrow Vs + Prt_2$	.04	.04	--
47. $T \rightarrow$ Past	.31	.33	--
Transformations			
48. Passive	.013	.014	--
49. Conjunction	.20	.20	--
50. Const. deletion	.59	.56	--
51. Adverb fronting	.21	.18	2.11
52. Adverb internal.	.24	.26	--
53. *There* insertion	.009	.008	--
54. Clefting	.008	.007	--
Grammatical errors			
55. Ungram. insertions	.19	.19	--
56. Ungram. deletions	.02	.02	--
57. False start	.08	.09	--
58. Sentence overlap	.04	.05	--
59. Total errors	.33	.34	--

$^{*}p < .05$

$^{**}p < .01$

--F score < 1.00

Table 14-B6

Means and F Scores for Strength Dimension on all Syntactic Variables Tested

Syntactic variables	Strong	Weak	F score
1. #Sent	41	35	2.77
Composite variables			
2. S_{emb}	.54	.51	2.64
3. $\overline{ADV}_i$	.56	.54	--
4. $\overline{AUX}$	.17	.18	--
Phrase structure rules			
5. Int	.07	.08	--
6. Conj	.03	.03	--
7. Conj Adv	.03	.03	--
8. Sen Morp → Q	.004	.005	--
9. Sen Morp → Imp	.001	.004	3.46^*
10. Sen Morp → Neg	.08	.08	--
11. VP → V_{int}	.05	.04	--
12. VP → Pred	.32	.29	2.24
13. VP → NP	.29	.34	8.07^{**}
14. VP → PP	.17	.17	--
15. VP → S	.21	.20	--
16. VP → ADV_i	.27	.28	--
17. VP → ADV_i+	.11	.12	--
18. Pred → AP	.58	.57	--
19. Pred → NP	.30	.33	1.02
20. Pred → PP	.12	.10	--

Table 14-B6 (continued):

Syntactic variables	Strong	Weak	*F* scores
21. ADV$_i$ → ADV$_t$	.31	.31	--
22. ADV$_i$ → ADV$_p$	.10	.11	--
23. ADV$_i$ → ADV$_m$	.50	.52	--
24. ADV$_i$ → ADV$_{pur}$	.08	.07	--
25. ADV → AP	.44	.41	1.71
26. ADV → NP	.30	.31	--
27. ADV → PP	.26	.27	--
28. NP → N	.61	.63	1.08
29. NP → D + N	.20	.20	--
30. NP → AP + N	.07	.08	1.52
31. NP → N + Comp	.05	.04	1.06
32. NP → S	.11	.10	1.75
33. NP — NP + S	.04	.03	--
34. D → Art	.65	.64	--
35. D → Dem	.17	.20	--
36. D → Gen	.17	.16	--
37. D → Pre-det + ...	.06	.05	--
38. AP → A	.82	.84	--
39. AP → A + Comp	.02	.02	--
40. AP → Adv + A	.16	.14	1.47
41. Aux — M	.08	.09	--
42. Aux — Perf	.03	.03	--
43. Aux → Prog	.06	.06	--
44. Aux → Incho	.01	.01	--
45. V → Vs + Prt$_1$	.02	.02	--

Table 14-B6 (continued):

Syntactic variables	Strong	Weak	*F* score
46. $V \rightarrow Vs + Prt_2$	.04	.05	--
47. $T \rightarrow$ Past	.33	.31	--
Transforamations			
48. Passive	.012	.014	--
49. Conjunction	.21	.19	2.18
50. Const. deletion	.57	.58	--
51. Adverb fronting	.20	.21	--
52. Adverb internal.	.26	.23	1.98
53. *There* insertion	.010	.007	1.09
54. Clefting	.009	.006	--
Grammatical errors			
55. Ungram. insertion	.17	.21	3.47^{*}
56. Ungram. deletion	.01	.02	5.95^{*}
57. False starts	.08	.09	1.39
58. Sentence overlaps	.05	.04	4.81^{*}
59. Total errors	.31	.36	3.02^{*}

$^{*}p < .05$

$^{**}p < .01$

--*F* score $\leq$ 1.00

APPENDIX C

THE GRAMMATICAL COMPLEXITY SCALE

Because grammatical complexity seems to be an underlying feature characteristic of many of the specific syntactic variables differentiating positive and negative effect, it is possible to maximize the individual contributions of separate variables by combining them to produce an overall scale of grammatical complexity. The items making up this scale should share all three of the following characteristics:

(1) Each variable should independently differentiate descriptions of pleasant and unpleasant emotions (or, at the very least, not contradict differences among variables that do differentiate these emotions).

(2) Each variable should be clearly related to grammatical complexity, so that variations within this variable increases or decreases the overall complexity of the sentence it occurs within.

(3) Each variable selected should not be redundant with or subsumed by other variables contained within the scale.

The first of the criteria contains a strong and a weak version. The strong version limits the selection of variables to those items that have been found to significantly differ for positive and negative effect, i.e., those 14 variables contained within Table 5:

I. Phrase structure rules

1. Semb, the proportion of embedded to total sentences

2. $\overline{\text{ADV}}_i$, the average amount of adverbial modification

3. $\overline{\text{AUX}}$, the average amount of auxiliary modification

Phrase structure rules (continued)

4. Sen Morp → Neg, the number of negative sentences
5. VP → ADV_i +, the number of sentences with multiple adverbial phrases
6. Pred → NP, the number of noun phrase predicates
7. ADV_i → ADV_p, the proportion of adverbial phrases that are adverbs of place
8. ADV_i → ADV_m, the proportion of adverbial phrases that are adverbs of manner
9. NP → N, the proportion of unmodified nouns
10. NP → S, the proportion of noun phrases containing embedded sentences serving as nouns
11. Aux → M, the proportion of sentences containing modals

II. Transformations

12. Adverbial movement, internalization
13. There insertion
14. Clefting

The weak version allows the extension of this rule to one other variable that meets the following two criteria but failed to differentiate positive and negative effect, i.e.,

$$AP \rightarrow A$$

This addition, which marks the expansion of adjective phrases into unmodified adjectives, seems necessary for conceptual completeness, since it is the only remaining variable that both contributes directly to grammatical complexity and is non-redundant with the remaining rule.

Differences between pleasant and unpleasant emotions on this variable (means = .84 and .83 respectively) were in the right direction but failed to reach statistical significance.

Of the 15 variables reaching either the strong or weak version of the first criteria, four can be eliminated on the second criteria, since they do not contribute to the grammatical complexity of the sentence

6. Pred $\longrightarrow$ NP
7. $ADV_i \longrightarrow ADV_p$
8. $ADV_i \longrightarrow ADV_m$
12. Adverbial movement, internalization

These rules simply describe the types of predicates and adverbial phrases normally found and the location of adverbial phrases within the sentence.

Three others can be deleted because they are subsumed by other measures in the scale and are therefore redundant:

5. VP $\longrightarrow$ ADV_i+
10. NP $\longrightarrow$ S
11. Aux $\longrightarrow$ M

The first of these, the frequency of multiple adverbial phrases, contributes directly to the overall amount of adverbial modification ($\overline{ADV_i}$). The second, the relative frequency of noun phrases expanded into a sentence, is one of the factors contributing to the proportion of embedded sentences (S_{emb}) and is also a contributing factor to the proportion of noun phrases expanded to a simple unmodified noun (NP $\longrightarrow$ N).

The third item, the relative frequency of modals, contributes to and helps make up the total amount of auxiliary modification ($\overline{AUX}$).

Because of the low frequency of clefting and there insertion transformations (.009 and .008 respectively), these transformation rules should be either omitted or combined into a single measure. The elimination of these rules would leave a scale that dealt only with phrase structure differences and contained no transformations. The combination of these two rules would produce a single measure -- extrapositioning -- which combines the relative frequency of each.

These eliminations and combination of rules leaves seven syntactic variables which meet all three of the above criteria of discriminability, grammatical complexity and non-redundancy:

1. S_{emb}
2. $\overline{ADV}_i$
3. $\overline{AUX}$

4. Sen Morp → Neg
5. NP → N
6. AP → A
7. Extrapositioning transformations

The next step in the development of a grammatical complexity scale is to change the directionality of rules so that they all correspond to the same trend. To do this, two rules must be modified,

NP → N becomes NP ↛ N

AP → N becomes AP ↛ A

While increases in the relative frequency of the other five variables indicate increases in grammatical complexity, increases in these variables prior to modification is characteristic of more simple sentence constructions, because the tabulate the proportion of unmodified nouns and adjectives. By changing the proportion of unmodified nouns and adjectives into the proportion of modified nouns and adjectives, these measure are made compatible with the remaining measures and all variables show the same trend, i.e., increases in the relative frequency of each variable is characteristic of increased grammatical complexity. The first of these is actually a composite measure for items 25 through 29, while the second is a composite measure for phrase structure rules 35 and 36.

The final step in the development of this scale is to provide a way for linear combination of separate elements into an overall scale representing grammatical complexity. Two separate procedures are recommended. Both measure the dispersion of an individual score about the mean for that score and provide a sign (+ or -) which indicates above or below average grammatical complexity on each measure and for all measures combined.

The first and simplest measure is a scores percentage (P) above or below the mean for each variable. This can be derived from the following formula:

$$\frac{P_i = X_{ij} - \bar{X}_i}{X_i}$$

where X_{ij} is the score for a given variable within a specific subject, cell or comparison made and $\overline{X}_i$ is the mean for that variable across all comparisons, i.e., the overall mean for that variable. Positive scores would indicate that the score was above the mean on that measure (i.e., more grammatically complex), while negative scores indicate more simple structures. The actual amount of complexity would be linearly related to the size of the score.

A second and slightly more sophisticated measure would be the use of z-scores, i.e.,

$$\frac{z = X_{ij} - \overline{X}_i}{\text{s.d.}}$$

where the standard deviation of a score is substituted for its mean in the demoninator. This measure has the same characteristics as the previous measure but it also takes into account the amount of dispersion about the mean.

For either measure, the total grammatical complexity score is simply the sum of each of the individual scores on each of the seven variables tested. This type of measure makes the assumption that each variable contributes equally to the overall effect. No weights are assigned. While differences in contribution may exist, these differences cannot be derived on the basis of this study alone and must await further investigation.

By doing a transformation on the scores of individual subjects or conditions, statistical procedures, such as analysis of variance, can be used to test differences among descriptions for statistical significance.

Correlations and correlationally based procedures, such as factor analysis and regression analysis, can also be made.

An example of how these scores can be used is given in Tables 15 though 17. Table 15 gives the individual and overall means for discrete emotions based on the seven variables used to measure grammatical complexity. Table 16 gives these same scores transformed into percentage above or below the mean, while Table 17 gives z-scores for each variable. The information in Table 15 is the same as that in Table 1 in the results section.

A quick look at either Table 16 or 17 shows that these transformations lend considerable clarity to what appears to be a set of random numbers in Table 15. It can, for example, be seen that no positive numbers occur among the three pleasant emotions (happiness, liking and curiosity) -- all scores are either negative or zero. This means that each of these three emotions were below average on each of the seven syntactic variables used to measure grammatical complexity. It can also be seen that, while negative numbers occur sporadicly among the descriptions of unpleasant emotional experiences, the overall effect is increased grammatical complexity for descriptions of unpleasant emotions, which is shown by summing the individual contributions of specific variables. The scale of grammatical complexity lends considerable clarity and economy to the differences among emotions and helps to reveal features of the phenomena not readily apparent when individual items are assessed alone.

Table 15

Individual and Overall Means for Discrete Emotions on Syntactic Variables

Used for Grammatical Complexity

Syntactic variables	Means for emotions							
	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust	Overall
1. S_{emb}	.48	.48	.51	.54	.54	.54	.54	.52
2. $\overline{\mathrm{ADV}}_f$	.48	.48	.47	.56	.61	.63	.64	.55
3. $\overline{\mathrm{AUX}}$	.16	.14	.18	.19	.22	.16	.17	.18
4. Sen Morp → Neg	.04	.07	.06	.11	.10	.09	.12	.08
5. NP $\not\rightarrow$ N	.38	.34	.38	.38	.41	.39	.41	.38
6. AP $\not\rightarrow$ A	.17	.17	.15	.22	.15	.17	.15	.17
7. Extrapositioning	.008	.013	.010	.012	.023	.016	.032	.016

Note. Emotions ranked on evaluation dimension.

Table 16

Application of the Grammatical Complexity Scale to Descriptions of Discrete Emotions,

Using Percentage Above and Below the Mean (P)

	P scores for individual emotions						
Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust
1. S_{emb}	-.08	-.08	-.02	.04	.04	.04	.12
2. $\overline{ADV}_i$	-.13	-.13	-.15	.02	.11	.15	.16
3. $\overline{AUX}$	-.11	-.22	0	.05	.22	-.11	-.05
4. Sen Morp → Neg	-.50	-.13	-.25	.38	.25	.13	.50
5. $NP \nrightarrow N$	0	-.11	0	0	.08	.03	.08
6. $AP \nrightarrow A$	0	0	-.12	.29	-.12	0	-.12
7. Extrapositioning	-.50	-.19	-.38	-.25	.31	0	1.00
Totals	-1.32	-.86	-.92	.53	.89	.24	1.69

Note. Emotions ranked on evaluation dimension.

Table 17

Application of the Grammatical Complexity Scale to Descriptions of Discrete Emotions, Using _z_ Scores

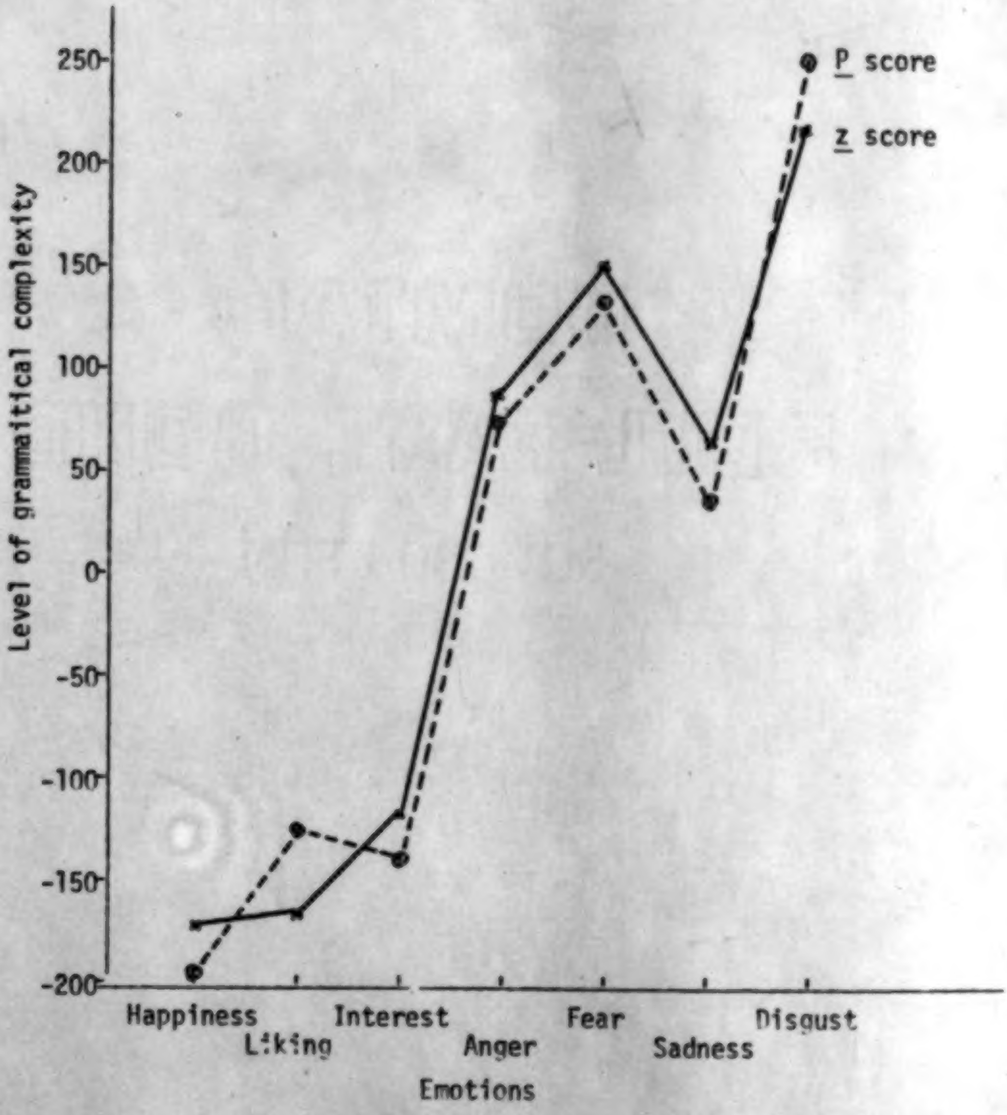
	_z_ scores for individual emotions						
Syntactic variables	Happiness	Liking	Interest	Anger	Fear	Sadness	Disgust
1. S_{emb}	-.28	-.28	-.07	.14	.14	.14	.41
2. $\overline{ADV}_i$	-.34	-.34	-.39	.05	.29	.39	.44
3. $\overline{AUX}$	-.17	-.34	0	.09	.34	-.17	-.09
4. Sen Morp → Neg	-.52	-.13	-.26	.39	.26	.13	.52
5. NP $\nrightarrow$ N	0	-.39	0	0	.29	.10	.29
6. AP $\nrightarrow$ A	0	0	-.14	.35	-.14	0	-.14
7. Extrapositioning	-.37	-.13	-.28	-.19	.33	0	.74
Totals	-1.68	-1.61	-1.14	.93	1.51	.59	2.17

Note. Emotions ranked on evaluation dimension.

The correspondence between the two measures, with P-scores adjusted for size (i.e., multipled by 1.49) is shown in Figure 1. As can be seen from this graph, the correspondence between these two scores is quite high (r = .96) and the two measures (at least for the present study) might be used interchangeably. Figure 1 also shows an almost linear increase in complexity as emotions are rated as more unpleasant. While all but one of the individual variables (i.e., AP → A) showed a low but significant correlation to the ratings given to an emotion on the evaluation dimension (r's ranged from .11 to .33), the combined scores show a very strong correlation between the scale of grammatical complexity and the evaluation dimension (r = .64).

Figure 1

Correspondence Between Grammatical Complexity Measures



Note: P score adjusted for compariability.